

The Pea Patch Island Heronry Region: Special Area Management Plan

July 1998

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Production of this Document Funded By:

The Delaware Department of Natural Resources and Environmental Control,
Delaware Coastal Management Program, Pursuant to
National Oceanic and Atmospheric Administration Award No. NA77OZ0182.



“Down back of Delaware City, near the Delaware and Chesapeake Canal, is a great swamp. It is many hundred acres in extent and is absolutely unfordable and impassable. In places are many trees growing out of the water and down below is a dense thicket shading the mud and ooze. It is such a place as snakes and frogs and slimy things inhabit. Crawfish in immense numbers make their homes in it. But above is a bird of paradise, and the thickets and the grasses and the trees are alive with them. In a small patch of maples a colony of great blue herons have built their nests. There were 89 of the nests in the bunch and 35 of them were apparently in use when examined one day, the last of March, 1912. The birds had just begun to lay their eggs and were very wild.”

*Quote by R.P. Sharples taken from
Life Histories of North American Birds by Arthur Cleveland Bent.*

EXECUTIVE SUMMARY

Special Area Management Plan - "A comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed comprehensive statement of policies; standards and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone." Federal Coastal Zone Management Act of 1972, 16 U.S.C.A. § 1453(17).

This Special Area Management Plan (SAMP) details why the Pea Patch Island Heronry Region is a natural resource worthy of protection and preservation. It also outlines how protection and preservation can be accomplished. The Island is home to the largest wading bird colony on the Atlantic Coast of the United States. The Delaware River, wetlands, and uplands that radiate 15 kilometers out from the center of the island support the foraging habits of these birds. The birds nest on the Island from March to September and depend on the Region's natural resources to sustain themselves and their offspring during this time. These wading birds are at the top of the food chain, making them a good indicator of what is happening in the environment that they live in; supporting the old adage, "You are what you eat."

This document is the culmination of work performed by many individuals and agencies with varied backgrounds, expertise, and interests. Together, they make up the Pea Patch Island Heronry Region Special Area Management Plan's Core Group, support staff, and stakeholders (see appendix A). The document covers the actual steps taken to create the SAMP framework, the problems or issues that were identified, the management strategies that were developed, and the plans for implementation, monitoring, and continuous management.

The SAMP development process relied upon a problem-driven, consensus building approach. Consensus building relies on the participation, input, and agreement of resource managers, scientists, business interests, and the people who live and work in the region, as well as those who are ultimately responsible for implementing management actions. This approach is designed to:

- Integrate the activities and resources of the various agencies and institutions with management responsibilities in the region;
- Take advantage of the available resources by pooling them to address problems too large or complex for any single agency/institution alone; and,
- Make the best use of existing knowledge and available information. This approach brings together the stakeholders early in the planning process and continues to use their knowledge and experience in shaping the actions to be implemented over time.

The following goals and objectives of the SAMP process were clearly defined at the outset by the Core Group and were used to maintain focus throughout the process.

*Pea Patch Island Heronry Region
Special Area Management Plan
July 1998*

- 1) The SAMP will provide the framework for making coastal resource management decisions that will ensure the long-term protection of the heronry and the natural resources that support it without harming the economy of the region.
- 2) The SAMP will result in the development of a series of policies and the necessary agreements required to implement these policies for the heronry region.
- 3) The SAMP will develop a broad ecosystem approach for addressing regional resource management issues.
- 4) The actual SAMP "process" will use existing information, facilitate cooperation among stakeholders, recognize and integrate existing management efforts, and provide incentives for implementation of proposed management strategies.

Members of the Core Group worked together to identify and select five issues for characterization. Issues are areas of concern that may be affecting the health of the heronry population and the region that supports it. Each issue was characterized in a simple consistent format describing potential sources of the problem, direct/indirect impacts, temporal and spatial characteristics, and recommended targets. The issues characterized are:

- Habitat Change - Development
- Pesticides
- Contaminants
- Oil Spills/Industrial Accidents
- Habitat Improvement and Protection
- Human Disturbance*

*Subsequent to the characterizations of the first five issues listed above, a sixth issue was raised. Human disturbance was a concern identified late in the process and efforts to characterize this issue began in October 1997. The human disturbance issue has gone through the full issue characterization process and it is located in Chapter VIII of this document.

Based upon these characterizations, management strategies were developed at a Strategy Workshop to address the problems identified and to reach targets. A total of sixty-six strategies were drafted and twenty-eight were selected to be refined for inclusion in the SAMP document. These twenty-eight strategies have been ranked for priority of implementation as listed in the Action Plan. The types of actions detailed in these strategies include: education/outreach, improved coordination, research/monitoring, revised policies/regulations, and technical assistance. To ensure continuous management of this SAMP an Implementation Team will be formed. This Implementation Team will be charged with continuous regional coordination, communication, planning, funding and strategy implementation of the SAMP.

The Action Plan for the first year of implementation consists of the strategies that were selected by the Core Group in December 1997. It is important to note that three of the twenty-eight strategies are already partially funded or underway, therefore they were excluded from the selection process. The amount of money available for the first year of strategy implementation was \$30,000. Out of the twenty-eight strategies four were selected to receive funding for implementation. The strategies and their designated allocations chosen for the first year Action Plan are:

- HD** *Develop Criteria for Determining Riparian Buffer Area Overlays. **allocated \$5,000***
- HI** *Securing Landowner Cooperation or Land Access/ Control for Wetland Restoration projects. **allocated \$5,000***
- HI** *Develop Specific Criteria for Heronry Requirements for Use in Land Acquisition and Protection. **allocated \$10,000***
- E** *Communication/ Outreach That Creates a Greater Awareness of the Heronry and its Importance for the General Public and Targeted Audiences. **allocated \$10,000***

The effectiveness of this Pea Patch Island Heronry Region SAMP document will not be measured solely by its statements or recommendations. Success will be determined by the Implementation Team's ability to facilitate interest in strategy implementation and environmental protection of natural resources on a regional and not just a site-specific basis. The birds of Pea Patch Island cannot differentiate between political and other jurisdictional boundaries, they only know to seek the resources that are necessary to sustain themselves and their young. It is hoped that this process, the SAMP document, and its implementation will be a catalyst for informed and operative regional environmental decision making.

TABLE OF CONTENTS

Executive Summary	i
Table of Contents	v
List of Figures	vii
List of Tables	viii
 Chapter I. Introduction	
The Challenge	1
The Resource	1
The Legislative Origin	2
The Framework	4
Core Group	4
Goals and Objectives	4
Issue Characterizations	5
Research & Biomonitoring Group	5
Strategy Development	6
Continuous Management	6
Action Plan	7
 Chapter II. The Birds of Pea Patch Island	
Issue Characterization	15
 Chapter III. Habitat Change - Development	
Issue Characterization	21
Strategies	26
 Chapter IV. Pesticides	
Issue Characterization	45
Strategies	48
 Chapter V. Contaminants	
Issue Characterization	61
Strategies	64
 Chapter VI. Oil Spills/Industrial Accidents	
Issue Characterization	91
Strategies	95
 Chapter VII. Habitat Improvement & Protection	
Issue Characterization	125
Strategies	128

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

Chapter VIII. Human Disturbance	
Issue Characterization	151
Strategy	159
Chapter IX. Outreach & Education	
Strategy	165
References	171
SAMP Documents	178
Acronyms	179
APPENDICES	
Core Group, Alternates & Support Staff	A
Participants	B
List of All Strategies	C
Charter Document	D
Institutional Matrix	E

LIST OF FIGURES

Figure 1	<i>15-km Study Area Locator Map</i>	x
Figure 2	<i>The SAMP Process Diagram</i>	12
Figure 3	<i>Abundance of Nesting Wading Birds at Pea Patch Island 1993-1997</i>	19
Figure 4	<i>Developed, Undeveloped & Protected Areas Map</i>	25
Figure 5	<i>Sediment & Fish Contaminant Evaluation Sites Map</i>	60
Figure 6	<i>Sensitive Areas Booming Strategy Locations Map</i>	90
Figure 7	<i>Major Shipping Channels & Dredged Material Disposal Map</i>	124

LIST OF TABLES

Table 1	<i>Meetings/Workshops of the SAMP Core Group</i>	<i>9</i>
Table 2	<i>Summary of Strategies</i>	<i>12</i>
Table 3	<i>Characteristics of Pea Patch Island Birds</i>	<i>18</i>
Table 4	<i>Strategy HD-1 Ensure Adequate Funding to Protect Habitat Through Fee Simple Land Acquisition in the PPI Heronry Region</i>	<i>29</i>
Table 5	<i>Strategy HD-2 Develop a Land Preservation Tool Box</i>	<i>32</i>
Table 6	<i>Strategy HD-3 Establish a Means to Recognize Property Owners and Developers That Help Preserve Natural Habitats</i>	<i>35</i>
Table 7	<i>Strategy HD-4 Develop Criteria for Determining Riparian Buffer Area Overlays</i>	<i>40</i>
Table 8	<i>Strategy HD-5 Incorporate Buffer Plans into the New Castle County Comprehensive Land Use Plan</i>	<i>44</i>
Table 9	<i>Strategy PE-1 Maintain/Expand Pest Management Educational Efforts</i>	<i>51</i>
Table 10	<i>Strategy PE-2 Determine Pesticide Use Within the 15-Kilometer Study Area</i>	<i>55</i>
Table 11	<i>Strategy PE-3 Inventory of Control Activities and Programs for Invasive Plants, Noxious Weeds, and Aquatic Plants</i>	<i>59</i>
Table 12	<i>Strategy C-1 Evaluate and Assess Impacts of Confined Disposal Sites Within the 15-Kilometer Foraging Area</i>	<i>67</i>
Table 13	<i>Strategy C-2 Establish and Implement Sediment and Water Quality Criteria for Avian Species</i>	<i>71</i>
Table 14	<i>Strategy C-3 Establish a Consistent Interstate Framework and Information Management System for Dredging Decision Making.....</i>	<i>75</i>
Table 15	<i>Strategy C-4 Target Pollution Prevention at Industries that Release Contaminants of Concern</i>	<i>79</i>

Table 16	<i>Strategy C-5 Assess Effects of Industrial Contaminants and Pesticides on Wading Birds</i>	84
Table 17	<i>Strategy C-6 Prioritize Hazardous Waste Sites for Clean-Up According to Wading Bird Usage</i>	88
Table 18	<i>Strategy OS-1 Produce Oil Spill Damage Assessment Estimates for Sensitive Areas</i>	98
Table 19	<i>Strategy OS-2 Standardize Oil Transfer Regulations in the Delaware River/ Bay</i>	103
Table 20	<i>Strategy OS-3 Pre-Stage Appropriate Spill Response Resources Near Sensitive Areas</i>	107
Table 21	<i>Strategy OS-4 Ensure That the Salem River Response Plan Effective</i>	111
Table 22	<i>Strategy OS-5 Establish Permanent Anchoring Points for Booming</i>	115
Table 23	<i>Strategy OS-6 Hold Spill Drills for all Sensitive Areas</i>	119
Table 24	<i>Strategy OS-7 Incorporate Hazing, Retrieval, and Transfer Plan in Wildlife Response Protocol</i>	123
Table 25	<i>Strategy HI-1 Secure Landowner Cooperation or Land Access/ Control for Wetland Restoration Projects</i>	132
Table 26	<i>Strategy HI-2 Reduce Phragmites and Other Invasive Species by 3,000 Acres Throughout the PPI Heronry Region Within 5-10 Years</i>	136
Table 27	<i>Strategy HI-3 Review Existing Restoration and Wildlife Plans for PPI Needs and Benefits</i>	141
Table 28	<i>Strategy HI-4 Regenerate and Perpetuate Nesting Habitat on the Island Within Five Years</i>	146
Table 29	<i>Strategy HI-5 Develop Specific Criteria for Heronry Requirements for Use in Land Acquisition and Protection</i>	150
Table 30	<i>Strategy HU-1 Managing Human Disturbance Within Pea Patch Island Heronry</i>	164
Table 31	<i>Strategy OE-1 Communication/ Outreach That Creates a Greater Awareness of the Heronry and its Importance for the General Public and Targeted Audiences</i>	170

15 km Study Area Locator Map Pea Patch Island Heronry Region

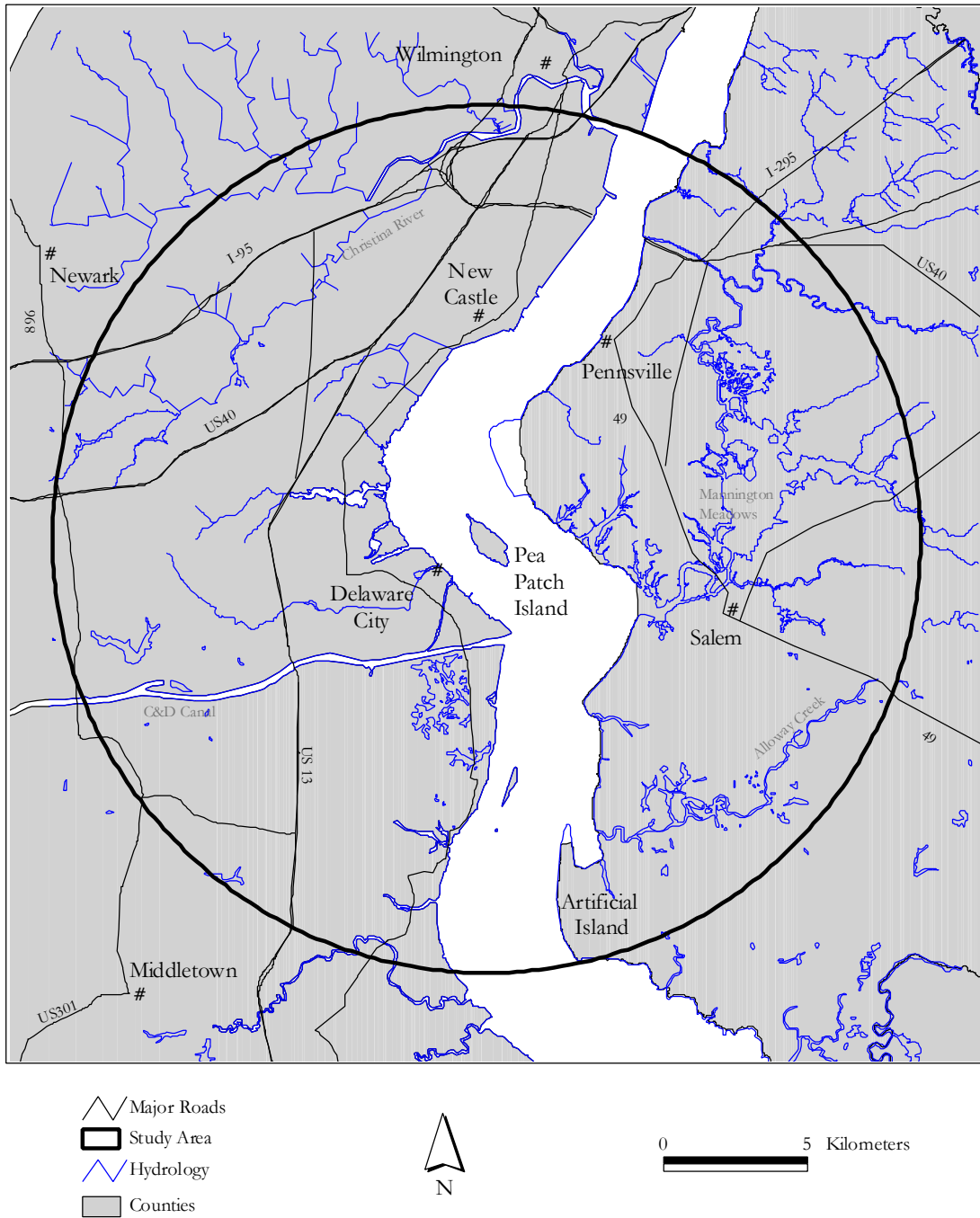


Figure 1. The Pea Patch Island Heronry Region Special Area Management Plan covers a geographical area that extends 15 kilometers out from the center of the Island. The 15-kilometer radius was chosen because it includes the primary foraging areas in Delaware and New Jersey that the birds of Pea Patch Island utilize. *Map created by the Delaware Coastal Management Program.*

INTRODUCTION

The Challenge

To develop a management framework that addresses the diverse and complex issues influencing the ecological health of a coastal resource of regional and national significance. This framework will follow a consensus-based approach that goes beyond political jurisdictions in order to recognize the myriad of interrelationships that occur within this regional ecosystem and the problems it faces.

The reasons for developing a management framework to protect the Pea Patch Island heronry are easy to understand. The colony of birds that nest there is certainly a treasured natural resource due to its size and composition of species. Creating a management framework for the heronry in terms of management on the island is a stand-alone task most often requiring internal consensus from only one agency. Protecting the region that surrounds the heronry is certainly complex due to political, economical, and environmental boundaries and limits. However, it is necessary for the long-term survivability of the heronry and the regional natural resources.

Using a consensus-based approach to management may seem a daunting task. Consensus is an ideological concept that is rarely attempted for fear of the result meaning nothing. If opposing views come together to achieve consensus, the result is likely to be so far compromised that it has no management implications. In reality, the result is simply friendly “policies” that look nice on paper sitting on a bookshelf but do nothing in terms of implementing and improving management. Most often joined with these “policies” is a lack of funding or a lack of an effective mechanism for implementation.

The Pea Patch Island Heronry Region Special Area Management Plan (SAMP) process has taken a consensus based approach, with the realistic view that for this approach to work, consensus may not always be reached. Coupled with this “realistic” approach, all parties involved were committed to this resource from the beginning of the process. Involvement and commitment meant more than attending meetings, it meant speaking up with concerns during the process so conflicts could be adequately expressed and conveyed to reviewing parties and decision-makers. As part of this process, particularly during strategy development, participants were asked to identify potential funding mechanisms and implementing agencies. Management strategies were ranked and selected based upon these criteria. Many of these strategies take a proactive approach rather than a reactive approach to management of this resource. Ultimately, implementation, funding, responsibility and commitment are the necessary elements of the SAMPs foundation that will make or break its effectiveness. The future success of the SAMP will depend upon the facilitation of interest in protecting the heronry and the region’s resources, continuous management, and administration of the strategies contained within this document.

The Resource

Pea Patch Island is a 310-acre island located in the environmentally degraded upper reach of the Delaware Estuary between the states of Delaware and New Jersey. Although located directly in the middle of the Delaware River, it is owned by the State of Delaware. The main shipping channel of the Delaware River is

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

located just 200 meters away from the island's Eastern Shore. This shipping channel is the lifeline to a large petrochemical industry and the regional ports of Delaware, Philadelphia, and New Jersey. The mainland of Delaware and New Jersey are fringed by tidal and man-made impounded wetlands and surrounded by agriculture and sprouting development. This area has felt the cumulative impact of anthropogenic activities in the region with increasing development, industrial activities, and agricultural practices. Despite years of human disturbance, the Pea Patch Island heronry has managed to sustain itself.

Scientists believe that nine different species of herons, egrets, and ibises began nesting on the northern part of Pea Patch Island in the 1950's and 1960's. At that time, the population was estimated at 2,000 pairs of birds. Over time, small heronries on the mainland in Delaware and New Jersey were abandoned and the population on Pea Patch Island increased. At its peak in 1993, the population was estimated at 12,000 pairs of birds (Parsons 1998). Pea Patch Island heronry is the largest heronry on the Atlantic Coast of the United States.

Concern for the sustainability of the heronry has grown over the past few years because the number of birds has been declining on the island. Population estimates for 1997 are 6,120 pairs (Parsons 1998). Research and biomonitoring conducted during the last five years indicates that there may be a problem with the long-term viability of the heron population on the island.

The heronry is considered a wildlife resource of national significance due to its size, diversity, and its unique location in a heavily used and impacted estuary. The complexity of managing a regional ecosystem that is under increasing pressure is the reason why the Delaware Coastal Management Program (DCMP) selected the region for the SAMP. The Pea Patch Island Heronry Region is defined as a 15-kilometer radius from the center of the Island, including parts of New Castle County, Delaware and Salem County, New Jersey (see figure 1). This 15-kilometer region was selected for inclusion in the SAMP because it covers a majority of the most important flying and foraging ranges of the herons that inhabit the island. The birds that nest on the island fly out to the wetlands and open fields of the mainland to find food for themselves and to bring it back to their young at the nests. These birds are at the top of the food chain utilizing the natural resources of the region, therefore they may be used as an indicator of what is happening in the environment. What is affecting their survival may indicate what may someday affect humans living in the same environment.

The Legislative Origins

The Federal Coastal Zone Management Act (CZMA) of 1972 was designed to encourage and assist coastal states to develop and implement management programs that would, "Preserve, protect, develop, and where possible, to restore or enhance, the resources of the Nation's coastal zone." *Coastal Zone Management Act of 1972 16 U.S.C.A. § 1452*. The authority to administer the CZMA and approve state designated coastal management programs was delegated to the National Oceanic and Atmospheric Administration (NOAA), an agency within the United States Department of Commerce. The DCMP and its policy document were approved by NOAA in 1979 with the entire state being designated as the coastal zone management area. The DCMP's policy document is a comprehensive set of goals and policies based upon state environmental laws and regulations, including executive orders. These enforceable policies ensure that the State's coastal resources are adequately protected. Section 307 of the CZMA provides for "Federal Consistency" which gives state coastal management programs the authority to evaluate and ensure that federal activities, permits,

plans and monies which may affect the coastal zone's land, water, and natural resources are "Consistent to the maximum extent practicable" with the coastal management program's enforceable policies.

Included as part of the DCMP's approval in 1979, an Executive Order was signed by then Governor, Pete duPont. Executive Order #61 declared that all State departments and agencies shall enforce the goals, policies, and objectives of the DCMP and notify the DCMP of proposed changes in rules or regulations which may have the potential for interfering with the DCMP or would require amendments to be made to the DCMP. The reason for establishing this Executive Order was to provide, "Sufficient legal authorities and organizational arrangements to implement the program (DCMP) and to ensure conformance to it." 15 CFR § 923.1(c)(6). In 1996, Governor Tom Carper signed an "updated" Executive Order #61, now known as #43, which reflects the organizational changes that have occurred since the original enactment in 1979. The 1996 version reintroduces and ensures all state departments and agencies enforce the goals, policies, and objectives of the DCMP.

It is imperative when trying to explain why the DCMP established the Pea Patch Island Heronry Region SAMP to look back at the legislative intent of Congress when it enacted the CZMA of 1972. By going back to the "roots" of the statute one finds that Special Area Management Plans were, and still are, a fundamental, comprehensive process to be used as an effective policy tool for coastal zone management.

"The Congress finds and declares that it is the national policy- (1) To preserve, protect, develop and where possible, to restore or enhance, the resources of the Nation's coastal zone for this and succeeding generations; (2) to encourage and assist the states to exercise effectively their responsibilities in the coastal zone through the development and implementation of management programs to achieve wise use of the land and water resources of the coastal zone, giving full consideration to ecological, cultural, historic, and esthetic values as well as the needs for compatible economic development...; (3) to encourage the preparation of special area management plans which provide for increased specificity in protecting significant natural resources, reasonable coastal-dependent economic growth, improved protection of life and property in hazardous areas, including those areas likely to be affected by land subsidence, sea level rise, or fluctuating water levels of the Great Lakes, and improved predictability in governmental decision making; (4) to encourage the participation and cooperation of the public, state and local governments, and interstate and other regional agencies, as well as of the Federal agencies having programs affecting the coastal zone in carrying out the purposes of this chapter; (5) to encourage coordination and cooperation with and among the appropriate Federal, State, and local agencies, and international organizations where appropriate, in collection, analysis, synthesis, and dissemination of coastal management information, research results, and technical assistance to support State and Federal regulation of land use practices affecting the coastal and ocean resources of the United States..." Coastal Zone Management Act of 1972 16 U.S.C.A. §1452 (1972).

Section 309 of the CZMA provides for Coastal Zone Enhancement Grants to States for the purpose of carrying out this section's specific objectives. In particular, one of the eight objectives defined in this section is, "Preparing and implementing special area management plans for important coastal areas." 16 U.S.C.A. § 1456b(a)(6). The statute defines a special area management plan as, "A comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed comprehensive statement of policies; standards and criteria to guide public and private uses of lands and

waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone.” 16 U.S.C.A. §1453(17).

The Framework

The Pea Patch Island Heronry Region SAMP process is a consensus-building effort that brings together stakeholders early in the process. This early involvement is an important step towards attempting to reduce conflicts after extensive work has been undertaken. The process is also designed to take advantage of existing environmental management programs and resources within the heronry region by looking for potential areas of cooperation and integration. Figure 2 and table 1 outline the process and the chronology of the SAMPs development.

The Core Group. The SAMP process began by convening a “Core Group” of people to oversee and contribute to the development of the SAMP. Members of this Core Group include Federal, State, and local resource agencies and governmental institutions, along with identified stakeholders in the Pea Patch Island Heronry Region. Staff from the DCMF and from the National Oceanic and Atmospheric Administration’s Strategic Environmental Assessments Division (NOAA/SEA) were committed to providing support to the Core Group through facilitating the planning process and developing the SAMP documents. The Core Group membership continued to grow throughout the process as additional stakeholders were identified. Please refer to appendix A and appendix B of this document for a complete list of participants and Core Group membership.

Goals and objectives. The first task of the Core Group was to agree upon the goals of the SAMP. They are as follows:

(1) To provide a framework for making coastal resource management decisions that will ensure the long-term protection of the heronry and the natural resources that support it without harming the economy of the region.

The heronry and the surrounding region are significant natural resources worthy of the protection a SAMP can provide; However, within the same framework those natural resources must also continue to support the economy of the region. The SAMP process looks at both sides of this spectrum in order to develop policies for effective management of this ecosystem.

(2) To develop a series of policies and the necessary agreements required to implement these policies for the heronry region. The critical aspect of the SAMP, aside from developing actual strategies to address problems in the region, is to provide for an effective means of implementing them. The SAMP will not be a document that “sits on the shelf.” It is designed to be a working document that will ensure implementation through continuous management by a governing body as defined in the Implementation Team’s Mission, Objectives, and Operations (included as appendix D).

(3) To develop a broad ecosystem approach for addressing regional resource management issues. The primary objective of this process is to develop a SAMP for the Pea Patch Island Heronry Region that will recognize the complex interrelationship among the biological considerations for the species, the habitat in which they live, and the impact human activities have on this resource.

(4) *To use existing information, facilitate cooperation among stakeholders, recognize and integrate existing management efforts, and provide incentives for implementation of proposed management strategies.* From its origin, the SAMP process utilized representatives from Federal, State, and local governments, industry, business, agriculture, non-governmental organizations, and local landowners as stakeholders with an identified interest and responsibility in the development and implementation of the SAMP.

Issue Characterizations. The Core Group was asked to identify the activities or conditions in the region that were potentially affecting the long-term sustainability of the heronry at Pea Patch Island. The group identified sixteen separate “issues” that could be affecting the heronry. A survey of the Core Group members was used to combine (where appropriate) and prioritize these sixteen issues into a manageable number to be addressed in the SAMP process. The resulting five highest priority issues to focus on were: Habitat Change - Development, Pesticides, Contaminants, Oil Spills/Industrial Accidents, and Habitat Improvement and Protection. In the future, priority issues may be added or deleted to best manage the resource through a continuous management approach.

After identifying the five priority issues, each was characterized using existing information from published scientific reports, interviews with knowledgeable experts, unpublished databases, and other sources. A draft characterization was written for each of the priority issues. These characterizations were sent to more than 100 stakeholders in the region (including New Jersey) along with an invitation to participate in a workshop to clarify the issues. Over 75 people attended the workshop held in December 1996. At the workshop, attendees selected which issue they were interested in helping to refine. The participants formed five smaller work-groups to address each of the issues independently. Each group discussed how to improve the existing characterizations by indicating information gaps, sources of concern, and identifying targets. After the workshop, the issue characterizations were refined based upon information collected at the workshop and then distributed to all of the workshop participants. These Characterizations were to be used to identify and develop strategies for meeting targets. All five Issue Characterizations are included in the *Pea Patch Island Heronry Region Special Area Management Plan: Issue Characterizations*, March 1997. Brief summaries of these issue characterizations are found in chapters III-VII of this document.

Another issue that was raised in October 1997, subsequent to the characterization and strategy development phases was that of Human Disturbance. Since the SAMP process is a dynamic one, the Core Group felt that it was important to address this issue, characterize it, and include it as part of the SAMP document. Chapter VIII of this document contains the fully characterized Human Disturbance issue for Pea Patch Island and a comprehensive strategy for implementation.

Research & Biomonitoring Group. A dialogue was raised at the Issue Characterization Workshop concerning the status of the research being conducted at Pea Patch Island. Questions were raised as to “current knowledge about the heron population at Pea Patch Island.” At that time only three years of consistent data had been collected on the wading bird population at the Island. Previous studies on the population had been conducted in the 1970’s and 1980’s, however each used a different methodology. Hypotheses had been formed as to population changes and the apparent decline, but clearly more information was needed before conclusions could be drawn or statements could be made. The Core Group realized that in order to make this SAMP work, a strong scientific foundation would be necessary for sound decision making and policy

**Pea Patch Island Heronry Region
Special Area Management Plan
July 1998**

formation. However, it was made clear that this process would be science-based with a proactive approach towards management as opposed to science-driven with a reactive approach towards management.

The Core Group requested that a Research & Biomonitoring Group, made up of scientists and researchers be convened to guide the direction and focus of the research in order to bring clarity to some of the unknowns that the Core Group was struggling with. The goal of this Research & Biomonitoring Group being to look at the unknowns, three years of data/information, and the Core Group's priorities to come up with a unified approach towards the 1997 scope of work.

Strategy Development. Participants from the December workshop were invited to a second workshop in April 1997 to develop and draft strategies that would focus on the problems associated with the five priority issues. Again, participants formed work-groups to address strategies for each of the five issues. Each group prioritized their respective strategies. Participants were given a template to complete which would outline information needed to describe and define their highest priority management strategies. A total of one hundred six strategies were identified at this workshop. At the end of the workshop, participants had completed templates for sixty-six of the identified strategies. These sixty-six strategies were compiled after the workshop and then distributed to the participants for review (*Pea Patch Island Heronry Region Special Area Management Plan: Strategy Workshop Summary Document*, June 1997).

At a subsequent Core Group meeting, these sixty-six strategies were ranked using criteria for: environmental and socioeconomic benefits or burdens, and the feasibility of strategy implementation. Based on the ranking criteria, thirty strategies were identified to be fully developed into strategy descriptions. During this process a few of the original thirty strategies were combined resulting in a final total of twenty-seven strategies. These final strategy descriptions are included in chapters III-VII of this document. The strategies are identified according to the Issue group they originated in at the April Workshop (ie. Habitat Change Development-HD, Pesticides-PE, Contaminants-C, Oil Spills/Industrial Accidents-OS, Habitat Improvement and Protection-HI). A strategy that originally was part of the Habitat Improvement and Protection section focusing on outreach and education efforts was separated into its own section due to the importance of outreach and education for each of the individual five issue areas and the SAMP process as a whole. Therefore, the outreach and education strategy OE-1 is not found within one of the five strategy sections but stands alone in its own section. After completion of the sixth issue characterization for Human Disturbance a strategy, HU-1, to address this issue was developed and added to this final SAMP document making for a total of twenty-eight strategies in all.

Each strategy description contains a table that outlines the most pertinent information about costs and implementation. The table is broken into sections according to individual activities. Proposed agencies for leading the strategy implementation and providing primary support are identified for each activity. The table also includes: the amount of person weeks required, the schedule for implementation (beginning with the first day of implementation), and the costs associated with completion of each activity. Each table covers the initial two years of implementation time and also indicates any ongoing or future annual costs associated with monitoring. Funding sources are identified by whether they are existing in-kind funds or potential sources that need to be investigated.

Continuous Management. With the completion of the final SAMP document, the continuous management will be taken on by a SAMP Implementation Team. This Team's mission will be to ensure the coordination, communication, planning, funding, strategy implementation and monitoring of the Pea Patch Island Heronry Region SAMP. This Team is designed to evolve from the original SAMP Core Group. The current Core Group would invite representatives from resource management agencies and stakeholder groups to become a part of the Implementation Team. The Implementation Team will be co-chaired by a rotating member selected from the Team and a permanent co-chair from the DCMP. The Team will meet on a quarterly basis and report on progress to the DCMP on a bi-annual basis. Issue Teams will be formed as sub-sets of

Implementation Team to focus on individual priority issues in the SAMP such as: habitat change-development, pesticides, contaminants, oil spills/industrial accidents, habitat improvement and protection, education and outreach, and human disturbance. These Issue Teams will seek out funding mechanisms and ensure implementation for their priority issue strategies. If new “issues” are raised after the final SAMP document, new teams will be created to characterize the issue, set targets, develop strategies, rank strategies, identify funding, and see through implementation. For a detailed description of the Implementation Team and Issue Team’s mission, objectives, and operations, please refer to appendix D.

Action Plan. The action plan consists of the strategies that were selected by the Core Group in December of 1997 for the first year of implementation of the SAMP. The amount of money available for strategy implementation was \$30,000. Out of the twenty-eight strategies that make up the SAMP document, four were selected using a detailed ranking process to receive funding for implementation. The strategies that were selected are:

HD-4 *Develop Criteria for Determining Riparian Buffer Area Overlays. **allocated \$5,000***

HI-1 *Securing Landowner Cooperation or Land Access/Control for Wetland Restoration Projects. **allocated \$5,000***

HI-5 *Develop Specific Criteria for Heronry Requirements for Use in Land Acquisition and Protection. **allocated \$10,000***

OE-1 *Communication/Outreach That Creates a Greater Awareness of the Heronry and its Importance for the General Public and Targeted Audiences. **allocated \$10,000***

In most cases, the amount allocated to each of the four selected strategies was not the total dollar amount needed to ensure completion of the strategy. In effect, this money will be used as “seed funding” for implementation allowing other agencies/entities to buy into the strategy and help support or fund the remaining portion.

In addition to the strategies listed above, three strategies that had been omitted from the ranking process because they were already partially funded or under-way are part of this year’s Action Plan. These three strategies are:

C-5 *Assess effects of industrial contaminants and pesticides on wading birds.* Baseline data has been collected for over five years to support this strategy. Research specific to the activities outlined in this strategy was initiated in the summer field season of 1997 and will continue into the 1998 field research season. This strategy is a pre-requisite to many other strategies because it will provide the data necessary to support a list of contaminants and/or pesticides of concern via the measurement of exposure and possible effects to the birds of Pea Patch Island.

HD-1 *Ensure adequate funding to protect habitat through fee simple land acquisition in the Pea Patch Island Heronry Region.* In Delaware, the Open Space Program coordinates the acquisition of various state lands: parks, fish and wildlife areas, forests, nature preserves, and cultural sites. This program is managed by the Land Preservation Office of the Division of Parks and Recreation in the Department of Natural Resources and Environmental Control. Since 1990, the program has been actively pursuing land preservation throughout Delaware. With the initiation of the SAMP, acquisition efforts will continue in the Pea Patch Island Heronry Region. The focus will be on protecting land identified as critical habitat for wading birds. Statewide funding is appropriated through fiscal year 1999 for this program through the 21st Century Fund. Funding would then have to be sought out for acquisition activities after fiscal year 1999.

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

HD-5 *Incorporate buffer plans into the New Castle County Comprehensive Land Use Plan.* Work on the creation of a buffer ordinance began in the summer of 1997 for inclusion into the environmental section of the Unified Development Code (UDC). As of December 31, 1997 the UDC was adopted by the New Castle County Council. Therefore, activities 1- 4 of this strategy are already complete. The activity that remains to be initiated is activity 5, the implementation phase of this strategy. This will involve the identification of overlay zones through a Geographical Information System of the areas where the buffer ordinance will be applied.

This introduction has been an attempt to convey in the most simple and concise format, two years of hard work utilizing an effective process for protection and management of a very special resource. The SAMP process has been, and will continue through implementation to be dynamic in its nature. What is written here is not set in stone. This document is a foundation to be built upon.

TABLE 1
Meetings/Workshops of the SAMP Core Group

<i>Date-Location</i>	<i>Purpose/Result</i>
<i>2/12/96 The Mallard House Smyrna, DE</i>	Convene some of the principals who will be critical to future SAMP development and poll them for how the project should proceed. The meeting resulted in an agreement to move forward with a consensus building process to develop the SAMP.
<i>6/11/96 Buena Vista Conference Center New Castle, DE</i>	Reach agreement on goals and objectives of the SAMP and the process used to develop it. The meeting resulted in the establishment of a phased approach to the SAMP and the identification of potential issues for the SAMP to address.
<i>7/25/96 Grass Dale Center Delaware City, DE</i>	Identify the issues to be addressed at the December '96 Issues Workshop and the process to build the material necessary to conduct it. The meeting resulted in the establishment of teams to build the information required for each of the six issues.
<i>9/9/96 Grass Dale Center Delaware City, DE</i>	Identify the goals and process for the December '96 Issues Workshop. The meeting resulted in the establishment of teams to build the information required for each of the six issues.
<i>10/17/96 Grass Dale Center Delaware City, DE</i>	Refine preparations for the December '96 Issues Workshop. The meeting resulted in the combination of two issues into one (net of five total) and assignment of roles for participants.
<i>12/17-18/96* Grass Dale Center Delaware City, DE</i>	Review the five issues and identify priority targets. The meeting resulted in revisions to all of the issues and the identification of high priority targets for each. See the March 1997 Issue Characterizations document for more details.
<i>2/11/97** DNREC Dover, DE</i>	Identify primary research concerns with regard to the SAMP. The meeting resulted in a set of research actions that were proposed for inclusion in SAMP activities.
<i>2/13/97 Grass Dale Center Delaware City, DE</i>	Initiate planning for April '97 Strategy Workshop and review Science Subgroup meeting results. The meeting resulted in a draft process for the upcoming workshop and the distribution of the draft Issues Characterizations document.
<i>3/20/97 Grass Dale Center Delaware City, DE</i>	Complete planning for April '97 Strategy Workshop. The meeting resulted in a detailed process for the upcoming workshop and the assignment of roles for participants.

**Pea Patch Island Heronry Region
Special Area Management Plan
July 1998**

4/2/97* Grass Dale Center Delaware City, DE	Identify and describe strategies to address priority SAMP targets. The meeting resulted in over 100 strategies being suggested with about two-thirds of them written up on four page forms. See the June '97 Strategy Workshop document for more details.
4/25/97 Tri-State Bird Rescue Newark, DE	Evaluate strategies to be considered for the Draft SAMP. The meeting resulted in over 66 strategies being evaluated and scored with regard to their environmental and socioeconomic impacts and the feasibility of their implementation.
6/5/97 Buena Vista Conference Center New Castle, DE	Identify subset of strategies to be considered for the Draft SAMP. The meeting resulted in the adoption of 30 strategies for the Draft SAMP and the establishment of five teams to further develop their implementation details.
9/5/97 Delaware River and Bay Authority Building New Castle, DE	Review and fill in implementation details for Draft SAMP strategies. The meeting resulted in the revision of staffing, funding, and other details for half of the 30 strategies for the Draft SAMP.
10/7/97 Buena Vista Conference Center New Castle, DE	Review and fill in implementation details for Draft SAMP strategies. The meeting resulted in the revision of staffing, funding, and other details for the remainder of the 30 strategies for the Draft SAMP.
10/21/97 Tri-State Bird Rescue Newark, DE	Identify Draft SAMP strategies to receive funding for immediate implementation. The meeting resulted in a set of scores for each strategy that was used to identify the subset would be funded directly from State of Delaware Coastal Management Program grants.
12/16/97 Grass Dale Center Delaware City, DE	Distribute preliminary Draft SAMP to Core Group for review and comment. Review strategy ranking results and select strategies for implementation. The meeting resulted in the selection of four strategies that will share initial implementation funding.
2/4/98 ** Delaware Economic Development Office Dover, DE	Provide and update on research efforts, identify research needs for the 1998 field season, and link priority heron data and research needs to specific high priority SAMP concerns. The meeting resulted in a revised task list for the 1998 field season and a list of questions and concerns that will be addressed by researchers.
2/11/98 Buena Vista Conference Center New Castle, DE	Discuss results of Research and Biomonitoring Advisory Group meeting and review comments about the Preliminary Draft SAMP.
2/24/98 Wallace Wallin School New Castle, DE	General public meeting. Provide public with details of the Pea Patch Island Special Area Management Plan. Allow public to ask questions and express concerns about the SAMP.

**Pea Patch Island Heronry Region
Special Area Management Plan
July 1998**

2/26/98
*Family and Fitness Center
Salem, NJ*

General public meeting. Provide public with details of the Pea Patch Island Special Area Management Plan. Allow public to ask questions and express concerns about the SAMP.

4/3/98
*Grass Dale Center
Delaware City, DE*

Discuss comments received about the Draft SAMP and further discuss the Charter Document. Develop a list of potential membership for the SAMP Implementation Team. The meeting resulted in revisions to the role of the Implementation Team and the development of a criteria for participation on the Implementation Team.

5/20/98
*Grass Dale Center
Delaware City, DE*

Presentation of the results of the 1997 field season and relevance to SAMP goals. Review of task list for 1998 field season. Distribution of draft invitation letter for participation on the Implementation Team.

* Workshop attended by over 60 participants from a variety of backgrounds.

** Meeting of the Research and Biomonitoring Group of the SAMP.

FIGURE 2:
SAMP Process Diagram

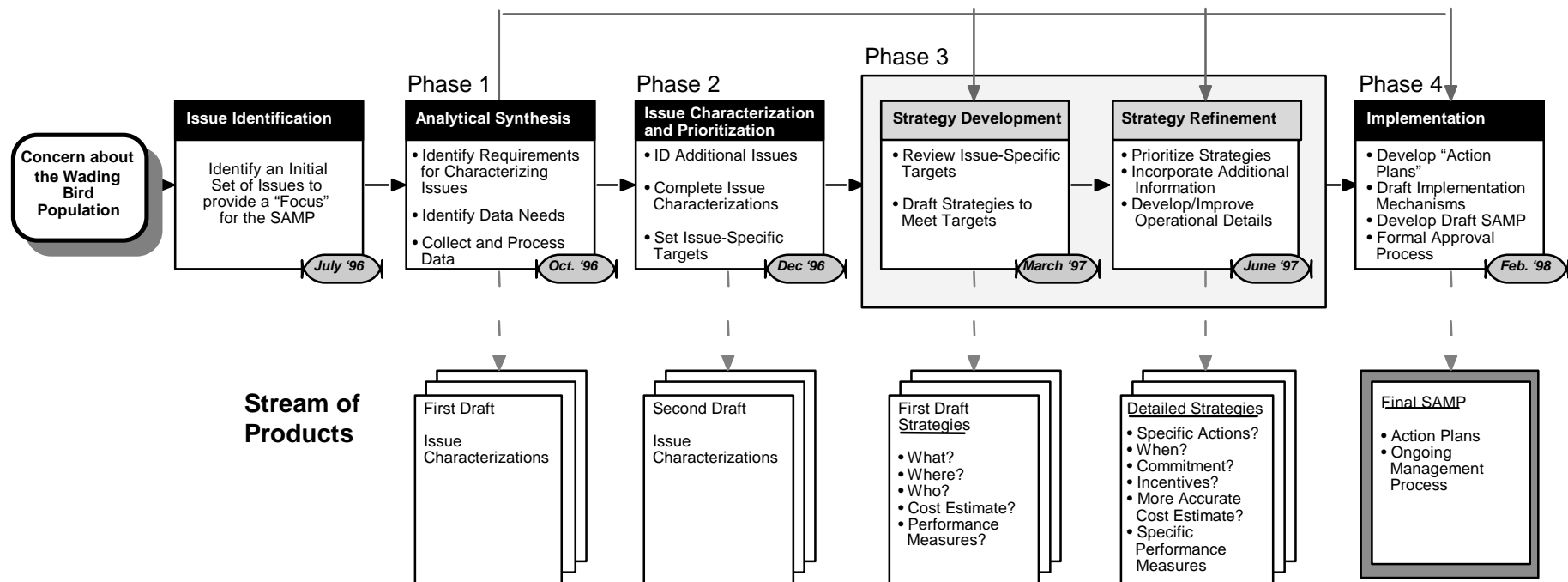


TABLE 2
Summary of Strategies

TABLE 2 Summary of Strategies						Total Cost (years 1-2)					Outputs											
		Lead Institution	Prerequisite Strategies	Completion Time (years)	Person Weeks	1-25 K	26-50 K	51-100 K	101-500 K	501+ K	Database or GIS Coverage	Report or Inventory	Technical Assistance	Regulations, Legislation or Agreement	Emergency Response	Research or Assessment of	Habitat Management	Actions	Public Outreach	Recognition or Awards		
Habitat Change and Development																						
HD-1	Ensure Adequate Funding to Protect Habitat through Fee Simple Land Acquisition	DPR		2	42	4						4							4			
HD-2	Develop a Land Preservation Tool Box	OSPC		1.5	17		4				4								4			
HD-3	Establish a Means to Recognize Property Owners and Developers that Help Preserve Natural Habitats	OSPC		1	24	4													4	4		
HD-4	Develop Criteria for Determining Riparian Buffer Area Overlays	DNREC	HD-5	1.5	28	4					4		4	4		4			4			
HD-5	Incorporate Buffer Plans into the New Castle County Comprehensive Plan	DNREC		1.25	48	4					4		4	4					4			
Pesticides																						
PE-1	Maintain/Expand Pest Management Educational Efforts	CES	C-2, C-4, C-5, PE-2	2	68				4			4	4						4			
PE-2	Determine Pesticide Use by Land Use	DDA		1	33	4						4				4						
PE-3	Inventory Control Activities and Programs for Invasive Plants, Noxious Weeds and Aquatic Plants	NCCD		1	16	4					4	4				4						
Contaminants																						
C-1	Evaluate and Asses Impacts of Confined Disposal Sites within the 15 km Foraging Area	DNREC		1.5	37		4					4				4						
C-2	Establish and Implement Sediment and Water Quality Criteria for Avian Species	DNREC	C-5	5	227					4	4			4		4						
C-3	Establish a Consistent Framework and Information Management System for Dredging Decision Making	DCMP		1.5	65			4			4			4								
C-4	Target Pollution Prevention at Industries that Release Contaminants of Concern	DNREC	C-5	1.5	25		4					4	4									
C-5	Assess Effects of Industrial Contaminants and Pesticides on Wading Birds	Manomet		2	364				4			4				4						
C-6	Prioritize Sites for Cleanup According to Wading Bird Usage	USFWS	C-5	2	32		4					4				4						

TABLE 2 (Con't)
Summary of Strategies

					Total Cost (years 1-2)					Outputs									
		Lead Institution	Prerequisite Strategies	Completion Time	Person Weeks (years 1-2)	1-25 K	26-50 K	51-100 K	101-500 K	501+ K	Database or GIS Coverage	Report or Inventory	Technical Assistance	Regulations, Legislation or Agreement	Emergency Response	Research or Assessment of	Habitat Management Actions	Public Outreach	Recognition or Awards
Oil Spills																			
OS-1	Produce Oil Spill Damage Estimates for Sensitive Areas	DNREC		0.75	22	4						4	4						
OS-2	Standardize Oil Transfer Regulations in Delaware River/Bay	DELEP		0.75	21	4								4					
OS-3	Prestage Appropriate Spill Response Resources Near Sensitive Areas	USCG	OS-1 OS-6	1	31		4					4			4				
OS-4	Ensure that Salem River Response Plan is Effective	USCG		0.75	17	4						4			4				
OS-5	Establish Permanent Anchor Points for Booming	PPAC	OS-1 OS-6	1.5	15	4	4					4			4				
OS-6	Hold Spill Drills for All Sensitive Areas	USCG		2	49				4			4			4				
OS-7	Incorporate Hazing, Retrieval, and Transfer Plans in Wildlife Response Protocol	USFWS	OS-6	1.5	52			4				4			4	4			
Habitat Improvement and Protection																			
HI-1	Secure Landowner Cooperation or Land Access/Control for Wetlands Restoration Projects	DNREC		2	31		4							4				4	
HI-2	Reduce Phragmites and Other Invasive Species	DNREC		10	40				4		4					4	4	4	
HI-3	Review Existing Restoration and Wildlife Plans for PPI Needs and Benefits	DNREC		On-going	26	4						4						4	
HI-4	Regenerate and Perpetuate Nesting Habitat on PPI	DNREC		On-going	43						4	4				4	4		
HI-5	Develop Site Specific Criteria for Heronry Requirements for Use in Land Acquisition and Protection	DNREC		1.5	52			4			4	4				4			
Human Disturbance																			
HU-1	Managing Human Disturbance within Pea Patch Island Heronry	DPR		3	43	4								4		4	4		
Outreach and Education																			
OE-1	Communication/Outreach that Creates a Greater Awareness of the Heronry	DNREC		5	72				4			4						4	

THE BIRDS OF PEA PATCH ISLAND

Bird Species

There are ninety-six bird species throughout world in the closely allied bird families of the herons, egrets and bitterns (Ardeidae), and the ibises (Threskiornithidae), twelve species of these long-necked, long-legged wading birds inhabit the Delaware Estuary. Nine species are gregarious birds, frequently breeding in complex nesting colonies. All nine of these species currently nest on Pea Patch Island in the Delaware River. They are:

Black-Crowned Night-Heron - <i>Nycticorax nycticorax</i>	Snowy Egret - <i>Egretta thula</i>
Yellow-Crowned Night-Heron - <i>Nycticorax violaceus</i>	Great Egret - <i>Casmerodius albus</i>
Great Blue Heron - <i>Ardea herodias</i>	Little Blue Heron - <i>Egretta caerulea</i>
Glossy Ibis - <i>Plegadis falcinellus</i>	*Cattle Egret - <i>Bulbulcus ibis</i>
Tri-Colored Heron - <i>Egretta tri-color</i>	

These birds usually wade along the shores of ponds, lakes, bays, streams, and marshes in search of fish, frogs, mice, invertebrates, and other foods. Although their bill is long and spearlike, they usually do not spear their food, but grasp it in their mandibles before swallowing it whole. The indigestible parts of the meal are later regurgitated. Although they do not have webbed toes, they can land in, and take off from, the water; but generally they just wade in shallow water.

*The Cattle Egret is the only species of the nine that nest at the Island that is not native to the United States. It originated in Africa and migrated over to North America in the early 1900's. However, it is now considered an important species and it is afforded the same level of protection as the other eight species by United States Fish & Wildlife Service.

Foraging Habitat

Most colonial wading birds acquire food in a variety of shallow-water areas, including: tidal and non-tidal rivers and creeks; ponds; impoundments; and brackish, freshwater and saltmarshes. Wetlands, especially coastal wetlands, provide the majority of foraging habitat for these large birds. The degradation and outright loss of these wetlands over the decades has eliminated over half of the potential foraging habitat for the wetland dependent species. Delaware lost approximately 57% of its wetlands between the mid-1950's and the early 1980's. In addition, poor water quality and high turbidity may affect the ability of these birds to find prey in the remaining wetlands. A few species occasionally forage in fields and pastures. The cattle egret is an exception, using open upland areas such as agricultural fields, pastures, roadsides, and lawns as its primary foraging habitat.

During most of the year, an individual heron, egret, or ibis may wander many miles from roost sites in search of the food necessary to sustain itself. During nesting season (April - July), the available foraging habitat is limited to the immediate vicinity of the nesting colony. During this period, each pair of birds must find enough food to survive and to raise their young. The time and distance each bird must fly to locate food, capture a sufficient quantity, and return to feed nestlings, is critical for successfully raising young birds. Nesting colony locations are believed to be selected, in part, by the proximity to excellent foraging habitat where large amounts of food can be easily caught.

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

Because of the different hunting techniques and prey species utilized by the wading birds, a wide variety of foraging habitats must exist within a short distance of a multi-species nesting colony. This is the case at Pea Patch Island. However, even under the best conditions, large colonies of wading birds occasionally must endure fluctuations in the availability of prey, which may affect one or more species in the colony. Researchers believe that herons and egrets hunt in loose aggregations because it enhances their ability to catch food and possibly reduces their risk of being eaten themselves.

Colonial wading birds are fairly long-lived; provided they survive their first year. Notable offspring mortality can occur during egg laying, incubation, hatching, and post-hatch. A significant known factor of mortality at Pea Patch Island is predation, which is attributed to the large crow population on the Island along with owls and raccoons. Also, offspring mortality is attributed to starvation and parasitic nematode infestation (Parsons 1996). Herons and egrets frequently live until they are seven, ten or occasionally fifteen years old. Most do not begin to breed until they enter their second summer. Once they reach the age of two, adult birds have an opportunity to breed every year for nearly a decade; potentially fledging as many as twenty or more young over their life span. Because of the high mortality rate in first year birds, mature birds must breed as many times as possible. These breeding birds are important for the survival of the species. Nestlings become expendable if the food supply dwindles in any given year. If this happens, adult birds will abandon nests and their young to ensure their own survival so they can breed another year. If poor breeding success occurs several years in a row, the nesting colony may be abandoned.

Although the greatest amount of food must be found during breeding season, it is vital that each individual bird find sufficient food to sustain itself throughout the year. For most of the wading bird species that hunt in the Delaware Estuary, this period extends from the earliest arriving migrants in the spring (March), to the post-breeding dispersal and fall migration (late-July through October). To survive until the next breeding season, each bird must find sufficient food during migration and on the winter foraging grounds in Florida, the Caribbean, and Central America. Two species, the great blue and black-crowned night herons, are commonly found in the Delaware Estuary year-round. However, not all of the individuals found during the winter months remain here in the spring. These individuals may migrate into the estuary from farther north and return there in the spring. A few snowy egrets and tri-colored herons have also been known to occasionally winter in Delaware.

Nesting Habitat

Colonies of wading birds have long fascinated and attracted human observers. Nesting colonies of herons and egrets can range from two to thousands of nests and from a single species to many different species. Population numbers of heronries are known to fluctuate, but most often are quick to stabilize. Pea Patch Island was home to nine different species and 12,000 nesting pairs of wading birds in 1993. Although there are still nine species nesting on the island, the number of nesting pairs has dropped significantly down to 6,120 in 1997 (Parsons 1998). This decrease is primarily due to a decline in the numbers of cattle egrets and snowy egrets. Not much is known about population dynamics of heronries and it is thought that each heronry is unique in its species composition, numbers, and holding capacity. In order to get a handle on the “best case scenario” for population numbers at individual colonies, usually a minimum of ten years of intense population monitoring is required before a conclusive statement can be made. As of right now after five years of monitoring, we cannot say that the large population drop at Pea Patch Island is a “normal population fluctuation” because long-term baseline data is not available to make that conclusion.

Typically, colonial wading birds build their stick nests in trees and shrubs, but a variety of nesting habitats are also used, including dense stands of common reed, *Phragmites australis*. The location of the nesting colony is chosen to reduce the disturbance of the colony by predators and humans, and to allow the birds to easily access adequate sources of food to raise nestlings. The most successful and persistent colonies are in isolated areas near a variety of alternative foraging habitats with abundant prey species. Historically in the

mid-Atlantic, nesting colonies occurred in maritime dune and shrub forests, isolated from mainland predators by dunes, bays and oceans on one side, with extensive marshes behind. Coastal development has eliminated most of these colonies. Today, nesting colonies are more frequently found on man-made spoil islands such as Pea Patch Island.

Each species of wading bird has different needs with regard to nesting habitats and strategies. Generally, the male bird establishes and defends a nesting territory, approximately twenty-five feet in diameter, until a suitable mate is found. When a pair is formed and nest-building begins, the defended territory becomes much smaller, usually confined to the immediate vicinity of the nest.

The position of the nests within the mixed-species colonies is determined by a variety of factors, including: bird size, timing of arrival at nesting areas, available nest sites, and territorial interactions. Great blue herons generally frequent the highest trees, and are the first to begin nesting. Great egrets, the second largest of the herons, will locate nests around the perimeter of the great blue nesting colony. The smaller, and later arriving birds frequently utilize shrubbery or Phragmites along the perimeter of the colony. From year to year the location of the densest nesting area in the entire colony is rotated. These birds may indirectly degrade the quality of their nesting habitat through excess guano deposition on vegetation and the ground. Large amounts of guano can alter soil pH levels that are not conducive to nesting substrate vegetation's growth and stability.

TABLE 3
INDIVIDUAL CHARACTERISTICS OF PEA PATCH ISLAND BIRDS

Species	Foraging Habitat	Diet	Nesting Habitat	Breeding Season	Eggs/Nestling	Regional Status (Pea Patch Isl.)
<i>Cattle Egret</i>	pastures, plowed fields, lawns, roadsides	grubs, beetles, grasshoppers, worms, insects	small-medium trees, shrubs, reeds	lay: early May hatch: late May to mid June	2-4 eggs 68% hatch 1 chick to 10 days	30% of Pea Patch total population, poor success, pop. declining
<i>Snowy Egret</i>	tidal wetlands, shallow brackish salt marshes	75% minnows, 25% grass shrimp	small-medium trees, shrubs, reeds	lay: lay April hatch: late May	2-5 eggs 77% hatch 1.4 chick to 10 days	20% of Pea Patch total population, poor success, pop. declining
<i>Glossy Ibis</i>	tidal mud flats, marshes, wet fields, lawns	invertebrates, worms, snails, insects	reeds, medium trees	lay: end of April hatch: late May very synchronous	usually 3 eggs 70% hatch 1 chick to 7 days	20% of Pea Patch total population, poor success, population cyclic
<i>Great Egret</i>	fresh to salt water, salt marshes	small to medium fish	medium to large trees	lay: mid-late April hatch: mid-late May	2-5 eggs	success unknown population increasing
<i>Little Blue Heron</i>	fresh, brackish water wetlands	50% frogs 40% small fish 10% invertebrates	small-medium trees, shrubs, reeds	lay: May hatch: late May	3-5 eggs 79% hatch 2.5 chicks to 10 days	10% of Pea Patch total population, good success, population declining
<i>Black-Crowned Night-Heron</i>	fresh to salt water wetlands, feeds at night, opportunistic	small to medium fish, shrimp	reeds, medium trees	lay: end of April hatch: late May	2-4 eggs 68% hatch 2.2 chick to 10 days	5-10% of Pea Patch total population, moderate success, population stable
<i>Great Blue Heron</i>	fresh, brackish, salt water wetlands	medium to large fish, amphibians	large trees	lay: end of March hatch: early May	3 eggs 60-90% hatch produce 2.3 chicks	5% of Pea Patch total population, good success, population stable
<i>Yellow-crowned Night-Heron</i>	tidal wetlands, creeks, guts	crabs	medium trees, reeds	lay: end of April hatch: late May	3-5 eggs	<5% of Pea Patch total population, success unknown, population cyclic
<i>Tri-colored Heron</i>	brackish and salt water wetlands, tidal marshes	fish, aquatic invertebrates	reeds, medium trees			<1% of Pea Patch total population, success unknown, very rare but stable presence

Abundance of Nesting Wading Birds at Pea Patch Island 1993-1997

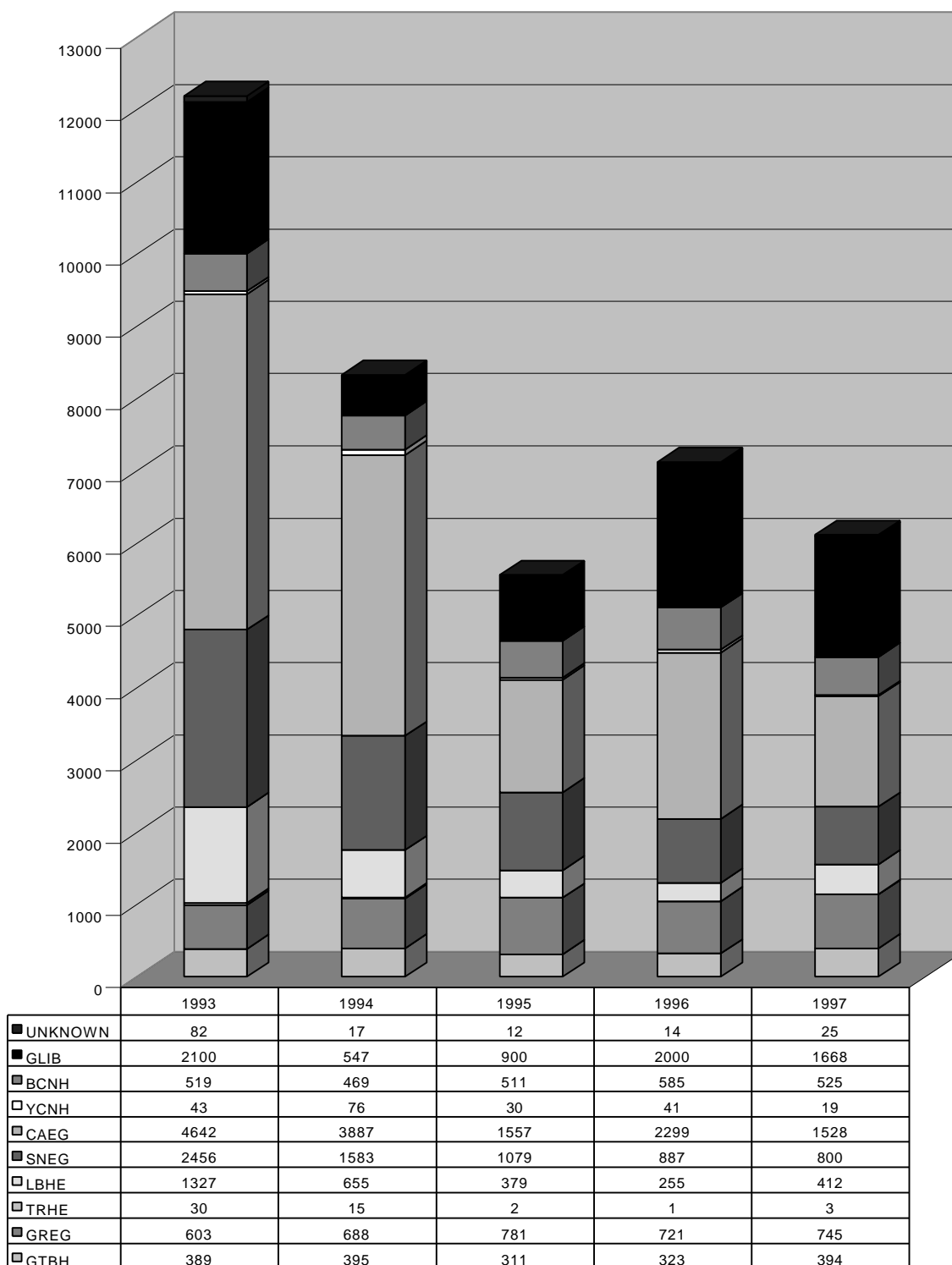


Figure 3. Abundance of nesting wading birds on Pea Patch Island, New Castle County, Delaware 1993 - 1997. Numbers given are estimated breeding pairs from ground-based and aerial surveys of colony. GTBH = Great Blue Heron; GREG = Great Egret; TRHE = Tricolored Heron; LBHE = Little Blue Heron; SNEG = Snowy Egret; CAEG = Cattle Egret; YCNH = Yellow-crowned Night-heron; BCNH = Black-crowned Night-heron; GLIB = Glossy Ibis (Parsons 1998).

HABITAT CHANGE - DEVELOPMENT

Description

The Pea Patch Island Heronry Region encompasses a variety of habitats located within New Castle County, Delaware and Salem County, New Jersey. Although generally rural in character, the region includes the city of Wilmington, and is adjacent to Philadelphia, Pennsylvania. With the exception of these major urban centers, property and housing costs in the region are relatively low, allowing a new residence to be purchased by an average income family, particularly first time home owners. As such, the region is experiencing rapid development. This can significantly degrade water quality and natural habitats in the region and present a challenge to local planners. Development is a concern since the species that comprise the heronry depend on a variety of healthy habitats for their survival.

Discussion

Direct Impacts. In both Delaware and New Jersey, the areas most often targeted for development include upland forested areas and areas previously used for agricultural purposes. Approximately 87,000 acres, roughly a third of the land in Delaware's New Castle County, is actively farmed. The majority of this is in the southern portion of New Castle county. This southern section (south of the Chesapeake and Delaware Canal) loses an average of 1,400 acres of agricultural land to development each year. This directly affects specific species of wading birds, such as the Cattle Egret (*Bubulcus ibis*) and the Glossy Ibis (*Plegadis falcinellus*) that utilize agricultural areas for foraging.

Indirect Impacts. In addition to the direct loss of habitat, increased stormwater runoff from developed areas has degraded adjacent wetlands and other natural habitats by increasing sediment, nutrient, and contaminant loads. These problems are most apparent near areas of dense residential and industrial development along the Delaware River north of Pea Patch Island and around the major urban centers.

New Castle County, Delaware, and to a lesser extent, Salem County, New Jersey, have been experiencing population growth and concurrent development over the past 15 years. As this has occurred, the potential for disturbing the wading birds in their nesting and foraging areas has increased. While visitation to the heronry on Pea Patch Island is strictly controlled, recreational use of the surrounding areas has increased.

Rapid growth and development can also lead to the isolation of critical habitats and species from larger ecosystem functions. This could lead to a loss in biodiversity over the long-term and could be very difficult to correct. In many areas within the Pea Patch Island Heronry Region, habitat fragmentation has already occurred. Although some preliminary work has been done by the Delaware Natural Heritage Program to identify critical habitats and the extent of fragmentation, the effects of this on wading bird species is not fully understood.

Type of Development. Development in New Castle County, Delaware is primarily residential and commercial; whereas in Salem County, New Jersey it is primarily residential. Most of this development is in the form of single-family homes in southern New Castle County and Salem County. Commercial development is also occurring in Delaware, primarily along major transportation corridors such as U.S. route 40. Much of this

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

development is service-oriented, supporting residents of the area and, to a lesser extent, the agricultural industry. Northern New Castle County and the western section of Salem County along the Delaware River support many industrial activities, especially petrochemical and energy production industries. Little, if any, heavy industrial development is expected to occur in the Pea Patch Island Heronry Region in the near future.

Existing Development Patterns. In southern New Castle County, the primary focus of residential development is within an area formed by the towns of Middletown, Odessa, and the Village of Summit. Most other development is scattered throughout southern New Castle County on lots one-acre in size or larger. Most of the commercial uses are located in Middletown. Northern New Castle County is already heavily developed, with the city of Wilmington and its surrounding suburbs. Much of the area consists of denser residential and commercial development.

In Salem County, the most heavily developed area is along the Delaware riverfront in Pennsgrove and Pennsville Townships. This is an urban/suburban corridor containing denser residential and commercial development in conjunction with numerous industries (the major industrial site is DuPont Chamber Works). In addition, Pilesgrove Township and the town of Woodstown were the focus of increased development in the late 1980's. A limited amount of residential and commercial development also has occurred recently within and to the west of the town of Salem.

Projected Development Patterns. In southern New Castle County, it is anticipated that the Middletown, Odessa, Summit area will experience the most dramatic growth in residential and commercial development, along with some light industrial growth. It is also anticipated that agricultural and unprotected vacant lands will continue to be lost to residential development in the form of single-family homes on lots one-acre in size or larger. In northern New Castle County, most future development will most likely involve the redevelopment of existing areas within and around Wilmington and the rapidly developing area along the U.S. Route 40 corridor and Churchman's Crossing. Isolated pockets of critical habitats could be adversely affected.

In New Jersey, Pilesgrove Township and the town of Woodstown in New Jersey are located close to the existing urban/suburban corridor along the Delaware River, and are within commuting distance of Wilmington and Philadelphia. It is anticipated that this area will undergo additional future development. Woodstown has also been approved as a center of development in the county's most recent master plan. Another development center has been proposed in the Mannington Meadows area.

Existing Protected Areas. Numerous natural areas in southern New Castle County have been purchased and are protected by federal, state, and local government agencies. These natural areas contain a variety of wetland and upland habitats. Additional acreage has been acquired and is being protected by non-government organizations. Much of this land contains fresh and saltwater marshes along the Delaware River and the C&D Canal, as well as scattered pockets of forested upland habitats.

In Salem County, many wetland and upland areas in the Pea Patch Island Heronry Region have been permanently preserved through easements and fee simple purchases by state and county agencies. In addition, under a cooperative agreement, the New Jersey Nature Conservancy is managing critical wetland habitats owned by PSE&G.

Potential Sources of Concern

Identified areas of concern are natural areas within the growth areas of Middletown, Odessa, Summit, Central Pencader, and Churchman's Crossing in Delaware and Pilesgrove, Woodstown, Salem, and Mannington Meadows in New Jersey.

The following sources/concerns have been identified as factors linked to the direct loss of habitat used for nesting or foraging, as well as a decrease in habitat quality.

Residential Development in Marginal Areas. Many of existing protected natural areas are non-contiguous, especially those associated with forested upland habitats. This is of concern because many of the habitats the wading birds depend on are, and continue to be, fragmented. Development of this kind can result in indirect impacts that reduce the quality of habitats the wading birds depend on. The continued development of forested uplands bordering wetlands and agricultural lands is an important issue to address.

Large Lot Low-density Development. Continued low-density scattered development that is occurring throughout the rural sections of the region, both in New Jersey and Delaware, is of great concern. This type of "rural sprawl" has the greatest potential for fragmenting habitats and reducing their utility to the species of concern.

Hydromodification. As new areas are developed, stormwater controls increasingly replace natural riparian functions. Improved site designs could benefit and better utilize natural habitats. This includes stormwater drainage practices associated with the construction of new, and expansion of existing, roads and highways. Improving stormwater control methods could protect riparian habitats and help improve water quality by reducing sediment and contaminant loads.

Land Owner Attitudes. How individual landowners develop their property, and how they manage it once it is developed has a significant impact on the ecological viability of the land. It is important that education and outreach efforts focus on raising the awareness of private landowners on the connections between land-use and habitat conditions.

Factors Affecting Development

Development patterns within and around the Pea Patch Island Heronry Region are the result of a mosaic of interacting, and sometimes conflicting causes. Decisions affecting the use of land, and ultimately the quantity and quality of habitats supporting wading birds and other species of concern, must attempt to balance economic and environmental considerations. These considerations include: land-use decisions, property and housing costs, population trends, legislation and regulations, economic incentives, transportation, infrastructure, and land suitability. Understanding these factors is critical for developing and implementing meaningful management strategies to support positive sustainable development and protection of critical habitats.

Recommended Targets and Strategies

Nine targets were developed by the Habitat Change - Development Workgroup at the Issue Characterization Workshop in December 1996. These targets are described in the *Pea Patch Island Heronry Region Special Area Management Plan: Issue Characterizations, March 1997*.

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

Descriptions for 18 management strategies were developed during and immediately after the Strategy Development Workshop in April 1997. A subset of 5 strategies were identified to be moved forward in the process for more refined thinking and description of implementation details. The strategies being addressed in the SAMP are:

- HD-1** Ensure Adequate Funding to Protect Habitat Through Fee Simple Land Acquisition in the PPI Heronry Region.
- HD-2** Develop a Land Preservation Tool Box.
- HD-3** Establish a Means to Recognize Property Owners and Developers That Help Preserve Natural Habitats i.e. Awards Program.
- HD-4** Develop Criteria for Determining Riparian Buffer Area Overlays.
- HD-5** Incorporate Buffer Plans into the New Castle County Comprehensive Land Use Plan.

Developed, Undeveloped, and Protected Areas Pea Patch Island Heronry Region



Figure 4. The Pea Patch Island Heronry Region encompasses a variety of habitats. Although generally rural in character, the region includes the city of Wilmington, and is adjacent to Philadelphia. The Heronry Region, being so close to these major urban centers makes it ideal for nearby, relatively low housing costs. Because of this, foraging areas in the region that are used by the herons of Pea Patch Island are being consumed by development. This increasing development could degrade water quality and important foraging habitats. *Map created by the Delaware Coastal Management Program.*

Strategy HD-1

Ensure Adequate Funding to Protect Habitat Through Fee Simple Land Acquisition in the Pea Patch Island Heronry Region

Activities:

- Identify and evaluate all options for funding of fee simple acquisition of open space.
- Prioritize options based on amount of funding available and duration of funding.
- Build public & political support for priority options.

Participating Institutions:

- Delaware Department of Natural Resources and Environmental Control
Division of Parks and Recreation
- Delaware Nature Society
- Open Space, Parks, and Farmland Preservation Coalition
- New Jersey Department of Environmental Protection
- Delaware Open Space Council
- Delaware Department of Agriculture; Farmland Preservation Foundation
- The Nature Conservancy
- Delaware Wildlands, Inc.
- Office of State Planning Coordination

Schedule: Work should begin as soon as possible in order to have options clearly articulated well in advance of any reductions in acquisition funds. Activities 1-2 can be completed in six months. Activity 3 will continue for at least 2 years.

Cost: \$21,000.

The states of Delaware and New Jersey have well established programs for the purchase of open space. Both states have also successfully acquired important habitat for wading birds and other wildlife within the Pea Patch Island Heronry Region. Delaware's Open Space Program and New Jersey's Green Acres Program have each been highly successful at permanently protecting critical habitats, primarily through fee simple acquisition.

Funding for the acquisition of open space properties comes from land and water conservation bonds, a portion of the realty transfer tax, and legislative appropriations. In Delaware, land acquisition has been significantly aided by a one-time appropriation by the State's General Assembly, the 21st Century Fund. This fund is only committed through 1999 and the lack of a replacement fund could severely curtail efforts to protect the most rapidly developing portion of the Pea Patch Island Heronry Region, Southern New Castle

County. This strategy is an effort to appropriately use remaining funds to protect those regions which are most important ecologically to the region.

Primary Activities

Activity 1. Identify and evaluate all options for funding of fee simple acquisition of open space. Identify all options for funding of fee simple acquisition. This will be conducted through a series of correspondences and meetings of representatives from agricultural conservation interests, habitat protection and management interests, civic organizations interests, and local & state governments. Options will include potential fund generating programs such as the Realty Transfer Tax (currently utilized as a “spill over fund”). It will also further explore bonds, additional appropriation, or new special taxes dedicated strictly to land protection through acquisition. Funding options identified will stress the need for a continuous funding source. This effort will be conducted by a “task team” established by the Pea Patch Island Heronry Region Implementation Team.

Activity 2. Prioritize options based on amount of funding available and duration of funding. Based on the findings of Activity 1, conduct a formal workshop with representatives from the Open Space, Parks, and Farmland Preservation Coalition and other local and state government organizations. This workshop will be a highly structured and deliberate process that will clearly articulate the preferred options for funding open space protection and acquisition programs. The outcome will be defined to ensure a common and united approach of a wide diversity of land protection interests.

Activity 3. Build public & political support for priority options. Develop and implement a detailed public outreach plan. The plan will include the distribution of materials explaining the various options for funding of fee simple acquisition, what the results of the options will be, and how the public can assist in the process.

Implementation

Institutional Responsibilities

The Pea Patch Island Heronry Region’s task team will provide leadership for focus on the Pea Patch Island Heronry Region and the Division of Parks and Recreation will focus on a broader statewide initiative. They will coordinate and champion efforts through the Open Space, Parks, & Farmland Preservation Coalition. This coalition is comprised of over three hundred representatives from agricultural preservation groups, civic groups, labor organizations, and local governments. Other supporting institutions would include New Jersey Department of Environmental Protection, Delaware Open Space Council, Delaware Department of Agriculture, Farmland Preservation Foundation, The Nature Conservancy, Delaware Wildlands, Inc., and the Office of State Planning Coordination.

Schedule

Activity 1, the identification and evaluation of all open space funding options will be conducted when funding becomes available. This activity can be completed within three months. Upon identification of options, a detailed workshop will be conducted to discuss and refine them as needed, and prioritize the best options. The highest priority options will be developed into detailed written form and used as the basis of a public outreach plan. Table 4 shows the complete proposed schedule for implementation.

Location

This strategy must consider statewide land acquisition needs. Focus on the Pea Patch Island Heronry Region in New Castle County, Delaware and Salem County, New Jersey will be emphasized by the Pea Patch Island Heronry Region Implementation Team established by the PPI Core Group.

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

Costs and Funding

Costs for Activities 1-2 will be approximately \$18,000. This cost represents mostly staff time. Activity 3 will require an additional \$3,000 for costs associated with developing and distributing outreach materials. See Table 4 for the costs associated with each strategy, total costs and possible funding options.

Performance Measures

Success will be measured by identification and allocation of funds for open space programs prior to the end of the 21st Century Fund (1999), and by an increase in public awareness of land acquisition options.

Review/Key Decisions

Review of open space funding options will be conducted by the Open Space, Parks, and Farmland Preservation Coalition, Delaware Department of Natural Resources & Environmental Control, New Jersey Department of Environmental Protection (for any NJ recommendations), Delaware Open Space Council, and the Office of State Planning Coordination.

Strategy HD-1 -- Ensure Adequate Funding to Protect Habitat through Fee Simple Land Acquisition

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Identify and evaluate all options for funding of fee simple acquisitions of open space.	DPR	OSPFPC, DNS, NJDEP	12	✓								12	0	In-kind services		DPR
2. Prioritize option based on amount of funding available and duration of funding.	DPR	OSPFPC, DNS, NJDEP	6	✓	✓							6	0		In-kind services	DPR
3. Build public and political support for priority options.	DPR	OSPFPC, DNS, NJDEP	24	✓	✓	✓	✓	✓	✓	✓	✓	3	0		In-kind services	DPR
Total Person Weeks = 42				Total Cost Quarters 1-8 = \$21,000												

Strategy HD-2 Develop a Land Preservation Tool Box

Activities:

- Design and develop a how-to/quick reference printed guide.
- Enhance and enlarge the existing State Planning web page.
- Distribute guides through libraries and state and county planning offices.

Participating Institutions:

- **Office of State Planning Coordination**
- Cabinet Committee on State Planning Issues
- Delaware Nature Society
- Delaware Wildlands, Inc.
- Brandywine Conservancy
- The Nature Conservancy
- Delaware Open Space Council
- New Jersey Department of Environmental Protection

Schedule: Work can begin as soon as funding is obtained. Project completion will take between one and two years, with re-evaluations and modifications to follow.

Cost: \$35,000

This strategy will develop a land preservation “tool box” for landowners, developers, planners & persons interested in planning issues. This “tool box” will provide information on land preservation options available in Delaware and a list, with contact person, of land preservation programs within the state. Information will be available on hard copy and on the Internet. Efforts will be made to keep the information current and readable on an 8th grade level. This information will be provided through the Office of State Planning Coordination, funding permitted.

Primary Activities

Activity 1. Design and develop a how-to/quick reference guide. Design and develop a how to/quick reference guide which will give landowners, developers and planners an easy-to-use source of information pertaining to land preservation options. Included within the guide will be a list of organizations/agencies with a contact person, phone number, address and e-mail address. Programs which will be included are: State Open Space and Preservation Program, Agricultural Lands Preservation Program, Division of Historical and Cultural Affairs, Division of Fish and Wildlife, Federal-Wetlands Reserve Program, Delaware Nature Society, Nature Conservancy of Delaware, Delaware Wildlands, Brandywine Conservancy, and New Castle County Department of Parks and Recreation. The guide will be a dated document and will be updated as necessary.

Activity 2. Enhance and enlarge existing State Planning web page. Enhance and enlarge the existing State Planning web page to provide quick facts on existing programs and pending legislation. The how-to guide developed in Activity 1 will be also be included. Links, if available, will be provided to the organizations listed above

and other relevant organizations. Links to information about pending legislation will also be included if available.

Activity 3. Distribute guides through libraries, state and county planning offices. Distribute hard copies of the how-to guide to libraries and state and county planning offices. These brochures will provide quick facts on existing programs and current and pending legislation. It will also include the list of organizations/agencies and contact persons. Brochures will be revised and reprinted as necessary.

Implementation

Institutional Responsibilities

The primary lead agencies will be the State Planning Coordination Office and the Cabinet Committee on State Planning Issues. However, numerous other agencies will need to participate in the outreach development process for successful implementation.

Schedule

Work will begin on the development of the quick reference guide (Activity 1) and the web page (Activity 2) as soon as possible. The project can be finished within a year and a half, although some ongoing work will be necessary for updates of both the guide and the web page. Table 5 shows the proposed schedule for implementation.

Location

This strategy will focus on the entire state of Delaware.

Costs and Funding

The anticipated cost of this strategy is \$35,000. Additional funding of up to \$5,000 per year may be necessary in order to update and publish information. See Table 5 for total costs and staffing resources associated with each activity.

Funding may be possible through the 21st Century Fund.

Performance Measures

Success will be measured by the number of hits to the State Planning web site and by the number of requests received for hard-copies of the how-to guide. The number of land preservation applications received by various organizations before and after the guide and “toolbox” were instituted could also be plotted against each other to graphically view this strategy’s overall impact.

TABLE 5

Strategy HD-2 -- Develop a Land Preservation Tool Box

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Design and develop a how-to/quick reference guide.	OSPC	State of DE county offices, DNS	4	✓	✓							14	0		21st Century Fund	
1. Enhance and enlarge existing State Planning web page.	DNREC	Contractual	7			✓	✓	✓				11	0		21st Century Fund	
4. Distribute guides to libraries, and state and county planning offices.	OSPC	State of DE county offices, DNS	6					✓	✓			10	5/year		21st Century Fund	
Total Person Weeks = 17				Total Cost Quarters 1-8 = \$35,000												

Strategy HD-3

Establish a Means to Recognize Property Owners and Developers That Help Preserve Natural Habitats

Activities:

- Review Office of State Planning's efforts to establish an awards program.
- Identify eligible property owners and developers who can be contacted when the awards program begins.
- Advertise the awards program.

Participating Institutions:

- Delaware Department of Natural Resources & Environmental Control
- Cabinet Committee on State Planning Issues
- Office of State Planning Coordination
- The Advisory Panel on Intergovernmental Planning and Coordination and the State Planning Citizen's Advisory Council
- New Jersey Department of Environmental Protection

Schedule: Activities 1-3 could take up to a year to complete. Awards will be offered on a yearly basis, making this an on-going strategy.

Cost: \$2,000

This annual award program will recognize those persons or organizations that have contributed to making Delaware a better place to live, now and in the future, by preserving natural habitats. The guide for this award will be the "Shaping Delaware's Future" goals as established by the Cabinet Committee on State Planning Issues in April 1995. The focus will be on good land use practices in development and renovation projects.

Property owners who preserve natural habitats will be recognized by these awards. Developers whose development designs protect land, habitat and natural resources will also be recognized.

Primary Activities

Activity 1. Review State Planning's efforts to establish an awards program. Review the draft proposal to establish an awards program for innovative design, development and renovations written by the Office of State Planning Coordination (OSPC). Determine if a category may be included which would recognize the efforts of property owners and developers to preserve natural habitats.

Activity 2. Identify eligible property owners and developers. Draft a list of potential property owners and developers who should be contacted when the awards program is finalized. Survey state and county agencies and private land trusts to determine which property owners and developers they recommend be recognized. OSPC will determine a ranking criteria. Once applications are received, OSPC will hold one meeting of

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

surveyed organizations to determine the top three finalists in each category. The Cabinet Committee on State Planning Issues (CCSPI) will determine the winners in each category, then hold a major press event on-site of one of the two top winning properties. The Governor and Lt. Governor should attend the event and present the awards, which could be a plaque, cash or certificates.

Activity 3. Advertise the awards program. Advertise the awards program through press releases, paid advertisements and targeted mailings or newsletters.

Implementation

Institutional Responsibilities

The Office of State Planning Coordination (OSPC), which staffs the Cabinet Committee on State Planning Issues (CCSPI), will be the lead agency in this strategy's implementation due to the State's current land use activities.

Schedule

Activities 1-3 could take up to a year to complete. Ideally, when the awards program is fully implemented, applications for awards will be due in mid summer and awards will be presented in mid fall on a yearly basis.

Location

Statewide.

Costs and Funding

To implement, this strategy will require less than \$1,000 in labor costs and less than \$1,000 in material costs. The total cost of each strategy and staffing requirements are outlined in Table 6.

It is anticipated that funding could be obtained through grants such as the EPA Sustainability Challenge Grant, EPA Pollution Prevention Grant, § 319 Grants, and the Delaware Estuary Program Grants.

Performance Measures

The success of this strategy will be measured by the number of award applications received, variety of statewide locations and developers submitting applications, press coverage, and a follow-up survey to gauge the public's reception of the awards program. The awards program should provide a good role model (as well as encouragement) for other landowners and developers.

Review/Key Decisions

The Delaware Office of State Planning Coordination should conduct review of this strategy and key decision making.

TABLE 6

HD-3 --Establish a Means to Recognize Property Owners and Developers that Help Preserve Natural Habitats

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Review State Planning's efforts to establish an awards program.	OSPC	DNREC, USFWS	8	✓								0.25	0		EPA Sustainability Challenge, \$319 Grants, Pollution Prevention grants	DELEP, EPA
2. Identify property owners and developers who can be contacted when the awards program begins.	DNREC DCMP	OSPC	8		✓	✓						0.5	0		EPA Sustainability Challenge, \$319 Grants, Pollution Prevention grants	DELEP, EPA
3. Advertise awards program.	DNREC	OSPC	8				✓	✓				1.25	0		EPA Sustainability Challenge, \$319 Grants, Pollution Prevention grants	DELEP, EPA
Total Person Weeks = 24				Total Cost Quarters 1-8 = \$2,000												

Strategy HD-4 Develop Criteria for Determining Riparian Buffer Area Overlays

Activities:

- Identify priority buffer zone objectives by land use.
- Assess site conditions throughout region.
- Review literature and interview buffer zone “experts.”
- Publish summary report with criteria, recommendations, rationale, and detailed maps.
- Conduct a seminar of design criteria findings.
- Determine program structure options for implementation of Pea Patch Island Heronry Region buffer zone criteria. (*OPTIONAL*)

Participating Institutions:

- Delaware Department of Natural Resources & Environmental Control
Delaware Coastal Management Program
- New Castle County Department of Land Use
- Salem County Planning
- Salem & New Castle County Conservation Districts
- New Jersey Department of Environmental Protection
- U.S. Fish & Wildlife Service - Delaware Bay Estuary Project
- The Nature Conservancy

Schedule: Work will begin as soon as staff and funding resources are available. It will take approximately 8 months to complete all activities leading to the publishing of the summary report (Activities 1-4). Comprehensive review process and refinement based on review comments is expected to take 6 months to one year from the date of distribution. The seminar will be held following revisions of the summary report.

Cost: \$13,000

A riparian buffer is land next to streams, rivers, and wetlands that is managed for perennial vegetation (grass, shrubs, and/or trees) to enhance and protect the natural resources associated with these habitats from adverse impacts of various land uses. Buffers provide protection of water quality, provide important wildlife habitat, preserve flood plains and provide recreational and aesthetic benefits. In the Pea Patch Island Heronry Region, buffers will provide additional site specific benefits such as the filtering of pollutants that run-off into vital wading bird foraging sites, providing a screen to lessen disturbances of birds. Buffers also provide potential forest fringe nesting habitat along waterways for satellite heronries. Local, State, and Federal governments across the country have recognized the multiple benefits of riparian buffers, and in many cases have developed a variety of programs to protect and restore riparian buffers. However, the technical standards and programmatic features used in these programs vary wildly. In

particular, strategies used to protect or improve water quality are not always clearly linked to the treatment design theory (e.g. Best Available Technology Practices) or local site conditions. In addition, they rarely have any standards set for wildlife benefits that are often stated in program objectives. Consequently, many riparian buffer programs are not as effective as prescribed. One of the primary causes for this problem is a lack of technical data to support riparian buffer criteria. In many cases, guidelines have been borrowed from other programs without reference to local conditions or even to the stated objectives of the proposed program.

This strategy will develop site-specific design criteria (widths, vegetation types, etc.) for buffers for all land uses and major local conditions in the Pea Patch Island Heronry Region. This will be done in a manner that will accommodate the multiple goals of water quality maintenance or improvement, wildlife habitat protection, bank stabilization, flood control, and erosion control. A riparian buffer area (RBA) is needed because there are currently no RBA ordinances in the Delaware portion of the Pea Patch Island Heronry Region. Wetland buffers do exist in the New Jersey portion.

Primary Activities

Activity 1. Identify priority buffer zone objectives by land use. Identify the priority objectives of buffer corridors for each land use in the Pea Patch Island Heronry Region. Objectives for each land use will include: improved water quality, increased wildlife habitat, shoreline stabilization and aquatic resources protection. Any land use change efforts underway in the region that will benefit or be detrimentally impacted by buffers will also be considered in the prioritization. The objectives will be ranked by each land use to determine design priorities. This will best be conducted at a highly structured workshop of planners, scientists, developers, and other parties that will be affected by buffers.

Activity 2. Assess site conditions throughout region. Planners and assisting technical staff will identify the base to be used for wetlands and water bodies (e.g. USGS DLG hydrology, state mapped wetlands, national wetland inventory, etc.). Based on this map, they will assess site conditions along the buffer corridor of all applicable water bodies and wetland areas using the COMPAS Delaware GIS overlay mapping and analysis system. This is particularly important for deciding the feasibility of buffers to provide the various benefits and the priority objectives outlined in Activity 1. Mapping and GIS analysis will identify:

- variation in soil types along the proposed buffer zones;
- variation in depth of water table;
- variation in slope;
- variation in vegetative character (land cover);
- summary of the existing and potential land uses;
- impervious surface estimates by watershed;
- wetlands, flood plains and sensitive areas including special habitats;
- proximity to identified wading bird foraging areas
- proximity to waters not fully supporting state water quality standards for fishable/swimmable;
- proximity to rare and endangered species;
- proximity to important fragmented habitat areas that will be linked by buffer zones;
- proximity to forests supporting forest-interior dwelling species.

Activity 3. Review literature and interview buffer zone "experts." Based on the priority objectives by land use (Activity 1) and the buffer zone GIS characterization and analysis, conduct an exhaustive literature review and hold discussions with experts to develop design criteria matrices and supporting information for all land uses. This approach will be used to develop criteria suitable and applicable to the specific conditions and natural resource needs of the Pea Patch Island Heronry Region.

**Pea Patch Island Heronry Region
Special Area Management Plan
July 1998**

Activity 4. Publish summary report with criteria, recommendations, rational, and detailed maps. A final report will be compiled and distributed that summarizes the prioritization of goals and objectives for land uses in the region, the GIS spatial analysis findings, the criteria established for various land uses and sub-regions, and the supporting technical literature and expert correspondences supporting the criteria.

Activity 5. Conduct a seminar of design criteria findings. An informational seminar will be held to explain the process used to establish specific buffer zone criteria for the Pea Patch Island Heronry Region and the details about the criteria. This will be accomplished by having both those that actively worked on the design criteria and various experts in the field present buffer zone information.

Activity 6 (Optional). Determine program structure options for implementation of Pea Patch Island Heronry Region buffer zone criteria. Given program objectives and site conditions, planners must decide how to apply design criteria for various land uses in the Pea Patch Island Region. This includes making decisions on specific criteria as well as making decisions on implementation mechanisms. This task will be closely linked with strategy HD-5 and will provide a technical review of various policy options under consideration for implementation. It will also include a review of various implementation mechanisms other than the proposed ordinances, such as buffer incentive programs, that will assist with implementation of buffer zones.

Implementation

Institutional Responsibilities

The Delaware Department of Natural Resources and Environmental Control and the Conservation Districts will be the lead agencies in the implementation of this strategy. Other supporting institutions will include county governments, NJDEP, USFWS, conservation organizations, and representatives of groups that will be effected by buffer zones on the various land uses.

Schedule

Once staff and fiscal resources are identified, identification of appropriate participants will be conducted; notification of the workshop will be sent out, and the prioritization workshop will be held within two months. Immediately following this, work will be initiated as part of COMPAS Delaware GIS Module for Pea Patch Island Heronry. GIS analysis will be completed with available digital data in 2-4 months (Updated NJ land use and DE & NJ Soils will not be available, detailed landcover will also not be readily available). Literature search & review will start upon availability of staff and be completed in approximately 6 months. Final report of design criteria and maps completed in approximately 6-12 months. The seminar will be conducted as soon as possible after the final report is distributed. See Table 7 for a summary of the proposed schedule.

Location

This strategy will focus on the Pea Patch Island Heronry Region, including ranges in New Castle County, Delaware and Salem County, New Jersey. Based on a more detailed review of New Jersey's existing buffer protection authority, the strategy will have a higher emphasis in Delaware where no authority currently exists for buffer zones.

Cost and Funding

This strategy will require approximately \$13,000 in additional funding. It is anticipated that staff cost, in part or in whole, will be covered by existing agency staffing. Approximately \$7,000 of this cost is associated with capital costs for new equipment, meetings, workshops and printing costs. See Table 7 for costs and staffing resources associated with each activity in this strategy.

It is anticipated that funds will be obtained through grants such as Delaware's Non-point Source Pollution Control Program, Delaware Estuary Program Mini-grants, and Delaware's Coastal Non-point Source Pollution Control Grant.

Performance Measures

The success of this strategy will be measured by the successful development of an approach to developing riparian buffer zone criteria that results in increased support for buffer zones. It will also provide detailed maps of buffer zone needs based on local conditions and a technical document outlining the buffer zone criteria for the Pea Patch Island Heronry Region.

Review/Key Decisions

Review of the strategy products and key decisions will be made by County Government staff and representatives of other organizations that will be implementing buffer zones in the Pea Patch Island Heronry Region.

TABLE 7

Strategy HD-4 -- Develop Criteria for Determining Riparian Buffer Area Overlays

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Identify the priority buffer zone objectives by land use.	DNREC	NCC and Salem Co.	4	✓								2	0		\$6217 and \$319 grants	DNREC, DELEP, CNPCP
2. Assess site conditions throughout region.	DNREC DCMF	County Conservation Districts	8	✓	✓							4	0		\$6217 and \$319 grants	DNREC, DELEP, CNPCP
3. Review literature and interview buffer zone "experts."	DNREC	County Conservation Districts	4	✓	✓	✓						2	0		\$6217 and \$319 grants	DNREC, DELEP, CNPCP
4. Publish summary report.	DNREC	County Conservation Districts	4				✓	✓				2	0		\$6217 and \$319 grants	DNREC, DELEP, CNPCP
5. Conduct a seminar of design criteria findings.	DNREC	County Conservation Districts	2					✓				3	0		\$6217 and \$319 grants	DNREC, DELEP, CNPCP
6. Determine program structure options for implementation of PPIHR buffer zone criteria.	NCC and Salem Co.	County Conservation Districts and DNREC	6						✓	✓			0		\$6217 and \$319 grants	DNREC, DELEP, CNPCP
Total Person Weeks = 28				Total Cost Quarters 1-8 = \$13,000												

Strategy HD-5 Incorporate Buffer Plans into the New Castle County Comprehensive Plan

Activities:

- Support New Castle County's efforts to adopt a Unified Development Code.
- Provide New Castle County with GIS coverages and maps.

Participating Institutions:

- **New Castle County Land Use Department**
- Delaware Department of Agriculture
- Delaware Department of Natural Resources and Environmental Control
 - Division of Fish and Wildlife
 - Division of Water Resources
 - Division of Parks and Recreation
- United States Fish and Wildlife Service

Schedule: Work has already begun on a draft Unified Development Code (UDC) in New Castle County which includes both a riparian buffer ordinance and a tree/woodland preservation ordinance. The UDC and the ordinance were passed on 12/31/97. It will take approximately a year to provide the county with GIS coverages and maps and adequate training to utilize them to the fullest extent possible.

Cost: \$53,000.

A riparian buffer is land next to streams, rivers, and wetlands that is managed for perennial vegetation (grass, shrubs, and/or trees) to enhance and protect the natural resources which are associated with these habitats from adverse impacts of various land uses. Buffers provide protection of water quality, important wildlife habitat, preservation of flood plains and provide recreational and aesthetic benefits. In the Pea Patch Island Heronry Region, riparian buffers may provide additional site specific benefits such as the much needed filtering of pollutants that run-off into vital wading bird foraging sites, provide a screen to lessen disturbances of birds. Buffers also provide potential forest fringe nesting habitat along waterways for satellite heronries.

Local, State, and Federal governments across the country have recognized the multiple benefits of riparian buffers, and in many cases, have developed a variety of programs to protect and restore them. However, the technical standards and programmatic features used in these programs vary wildly. In particular, strategies used to protect or improve water quality are not always clearly linked to the treatment design theory or local site conditions. In addition, they rarely have any standards set for wildlife benefits that are often stated in program objectives. Consequently, many riparian buffer programs are not as effective as prescribed. One of the primary causes for this problem is a lack of technical data to support riparian buffer criteria. In many cases, guidelines have been borrowed from other programs without reference to local conditions or even to the stated objectives of the program.

**Pea Patch Island Heronry Region
Special Area Management Plan
July 1998**

This strategy, in addition to supporting the passage of the UDC (which includes buffer ordinances), will provide information and technology to New Castle County which will enable the development of sound regulations concerning both riparian buffer areas and woodland preservation.

Primary Activities

Activity 1. Support New Castle County's efforts to adopt a Unified Development Code. SAMP participants will provide technical assistance to county staff for the development of the Unified Development Code. They will participate in committee meetings, planning board meeting and workshops to facilitate the passage of a sound riparian buffer ordinance and a sound tree/woodland preservation ordinance. The UDC and the ordinance were passed on 12/31/97.

Activity 2. Provide New Castle County with GIS coverages and maps. It is essential for county governments to be familiar with GIS technology and how it can be used to help better legislative decisions be made. GIS coverages of different wetland types will be provided to the county. The coverages will be based on a classification scheme that considers sensitivity, rarity, plant community and wildlife habitat zones. This information is essential to determine the overlay zones of the areas where the RBA and tree/woodland ordinances will apply. Software and training will also be provided to enable the county to utilize and maintain this database.

Implementation

Institutional Responsibilities

The New Castle County Land Use Department will be the lead agency with support from Delaware Department of Natural Resources and Environmental Control's Division of Water Resources and Parks and Recreation. Other support will come from the Delaware Department of Agriculture, United States Fish and Wildlife Service, conservation organizations, and representatives of groups that will be affected by buffer zones on the various land uses.

Schedule

Once the UDC is passed and funding is obtained, work can begin on GIS coverages of wetland areas. The coverages and training will be complete within 1 year of the passage of the UDC. See Table 8 for a preliminary time frame for each activity.

Location

This strategy will be focused on the Pea Patch Island Heronry Region within New Castle County.

Cost and Funding

Much of the costs are part of the operating budget of the New Castle County where staff time is dedicated to developing and refining codes and local legislation. Capital costs of \$5,000 are estimated for the development of the GIS coverages and for the training sessions. See Table 8 for the cost and staff resources associated with each activity.

It is anticipated that funds could be obtained through grants such as Delaware's Non-point Source Pollution Control Program, Delaware Estuary Program Mini-grants, & Delaware's Coastal Non-point Source Pollution Control Grant.

Performance Measures

Success of the strategy will be measured by the development of key land use regulatory codes which will result in protecting habitat for the health and well-being of colonial nesting birds at the Pea Patch Island Heronry as well as improved water quality and habitat for the entire region.

Review/Key Decisions

Review of the strategy products and key decisions will be made by County Government staff and representatives of other organizations that would be implementing buffer zones in the Pea Patch Island Heronry Region.

TABLE 8

HD-5 -- Incorporate Buffer Plans into the New Castle County Comprehensive Plan

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Support New Castle County's efforts to adopt a Unified Development Code.	NCCLUD	DNREC, USFWS	30	✓	✓	✓						30	0	\$6217 and \$319 grants		NPS, DELEP, CNPCP
2. Provide New Castle County with GIS coverages and maps.	NCCLUD	DNREC, USFWS	18			✓	✓	✓				23	0		\$6217 and \$319 grants	NPS, DELEP, CNPCP
Total Person Weeks = 48				Total Cost Quarters 1-8 = \$53,000												

PESTICIDES

Description

This issue characterization for “pesticides” encompasses two specific types of pest inhibitors: herbicides and insecticides. Herbicides are used to control growth of pestiferous vegetation, and insecticides are used to control pestiferous insect populations. Both of these types of pesticides are used to optimize food production, protect human populations from disease vectors, and promote favorable aesthetic conditions for home lawn care, golf courses, and other landscaped areas. Pesticide applications can potentially result in direct and indirect adverse effects to non-targeted wildlife populations through actual poisoning or through loss of habitat quality and reduced food sources.

The Pea Patch Island Heronry Region relies on a variety of pest management methods other than chemical pesticides. These methods include engineering solutions like mosquito open marsh water management and impoundment water management, and biological controls like bacteria and genetic engineering.

Discussion

Direct Effects. Pest control methods may impact heron populations in the Pea Patch Island region either directly or indirectly. Exposure to pesticides can include: primary exposure, where non-target animals come into direct contact with pesticide applications; and secondary exposure, where non-targeted animals ingest contaminated prey. Direct effects can be acute (e.g. wildlife kills) or chronic (e.g. neurological impairment).

Agrochemicals, such as organophosphate and carbamate pesticides, can enter wetlands and other wading bird habitats through direct applications or indirectly through runoff or drift. Birds are potentially exposed to these compounds while they forage for prey. Laboratory studies show that anti-cholinesterase chemicals can result in acute and chronic toxicity of animals when sufficient exposure levels are achieved (Grue et al. 1983, Palmer and Bromley 1992, Hill 1995).

Preliminary results from a monitoring study on the birds of Pea Patch Island show depressed levels of cholinesterase in blood serum samples from some species. Cholinesterase is an important neural enzyme that is necessary in the function of nerve transmissions. Although moderate depression of serum cholinesterase is not known to be associated with adverse physiological responses, it does serve as a sensitive indicator to organophosphate and carbamate exposure. Organophosphates and carbamates are known as modern or “second generation” pesticides. They have a low to moderate persistence in the environment making them more desirable than their predecessors organochlorines, which readily biomagnify in the environment. The problem that researchers encounter when looking at cholinesterase in these birds are the many variables known to influence cholinesterase levels (age, weight, blood vs: brain sampling, temperature, and other environmental stressors). All of these variables are important in making an assessment of exposure and any possible links to effects or direct impacts. The past five years of research indicates some evidence of exposure to these compounds. However, considering all of the factors and differing opinions in the scientific community it has yet to be conclusively determined if this exposure has had a direct impact upon the population at Pea Patch Island. A conclusive statement about the level of exposure to cholinesterase inhibiting insecticides and the effects of low cholinesterase levels in birds cannot be crafted at this point in time.

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

Available information is insufficient to assess the significance of pesticide exposure to wading bird physiology, reproductive performance and population levels. More research is needed to: 1) determine the significance of these symptoms to bird populations; 2) identify the chemical compounds and route of exposure that might be responsible for adverse effects; and 3) identify and evaluate the foraging habitats utilized by adult birds with low cholinesterase-level nestlings.

Indirect Effects. Pest control methods may indirectly impact Pea Patch Island's herons both in their nesting and foraging habitats. These may include various impacts such as changes in vegetative cover of habitats and impacts to prey abundance.

Herbicides are the most commonly used pesticide on the Delmarva peninsula with metalochlor, alachlor, and atrazine accounting for about 70 percent of the herbicides used (Hamilton 1992). Generally, herbicides are relatively nontoxic to birds and their prey (vertebrates and invertebrates). However, relative toxicity is highly dependent on chemistry and exceptions to this generalization exist. Herbicides are designed to eliminate vegetation and are therefore most likely to impact herons and other wildlife indirectly. Herbicides are often used to alter habitat for wildlife and land management (e.g. phragmites control). Habitat alterations that are beneficial to some species are detrimental to others. Possible indirect adverse effects that could be associated with herbicide use and the herons at Pea Patch Island include direct reduction of nesting structure and cover (trees and shrubs) and indirect reduction of prey availability associated with herbicide related alterations of habitat.

Pesticides with greater toxicity to vertebrates and invertebrates may directly affect heron prey species (e.g. fish kills). There is not much evidence of fish kills resulting from pesticides used in the Pea Patch Island region. Between 1990 and 1995 there were two reported fish kills which were attributed to pesticides (Miller 1996). There is little information to suggest pesticide use in the Pea Patch Island region results in population level effects to prey communities. However, the habitat component of wading bird population dynamics has not been thoroughly evaluated. Habitat issues have been identified as a priority issue for the Pea Patch Island SAMP. Current research to characterize the status of nesting and foraging habitats may indicate a need for additional focus on how herbicide related alteration of habitat may effect herons.

Potential Sources

Pesticides are used in many settings including agriculture, lawn care and landscaping, golf course management, invasive plant management, infrastructure right-of-way, and noxious insect control. Information on actual rates of chemical applications to the Pea Patch Island region (15 km radius from the island) are largely unavailable. Little information is available on temporal or spatial factors that influence pesticide applications in agriculture and turf grass management. Agricultural pesticide application in Delaware and New Jersey varies from year to year based upon crop prices (which influences what crops are planted), crop rotations, seasonal weather, and pest populations.

At least 60% of the agricultural acreage in Delaware is under a structured Integrated Pest Management (IPM) program. Pest scouting and treatment thresholds are used to determine when a pesticide should be applied. In most cases, the decision to use a pesticide is based on the presence of the pest, pest density, and economic threshold. Producers select the most effective material to control the pest. Whenever possible, growers choose the material that will preserve beneficial insects and is the least toxic to the environment as long as it really controls the pest. In addition, whenever possible, growers use crop rotation, row spacing and adjust planting dates to avoid pest problems. New pesticides are currently being developed, and these will be more specific to the pest requiring eradication.

Trying to answer the questions about pesticides involves looking at the individual pesticide, its purpose, the time of year it is applied, the method of application, the frequency of use, and the extent of its spatial applications. These questions are not easily answered. Because of society's reliance on pesticides to

accomplish the critical tasks of growing food and protecting public health, substantial investment has been made in understanding and developing safer products and mitigating adverse effects. Examples of these activities include: Lawn Care (home/golf course)- An altered view point regarding aesthetic lawns; Farming-Revised practices (Best Management Practices), natural pests, and/or natural pesticides; Genetic Engineering-Disease resistant plants and sterile pests; and, Mosquito Control- Water management in impoundments and open marsh water management.

Recommended Targets and Strategies

Two specific targets were developed by the Pesticides Group at the Issue Characterization Workshop in December 1996. These targets are described in the *Pea Patch Island Heronry Region Special Area Management Plan: Issue Characterizations*. Descriptions for 9 management strategies were developed during and immediately after the Strategy Development Workshop in April 1997. A subset of 3 strategies were identified to be moved forward in the process for more refined thinking and description of implementation details. The strategies being addressed in the SAMP are:

- PE-1** Maintain/expand Pest Management Education.
- PE-2** Determine Pesticide Use Within the 15 Kilometer Study Area.
- PE-3** Inventory of Control Activities and Programs for Invasive Plants, Noxious Weeds, and Aquatic Plants.
- C-5** Assess Effects of Industrial Contaminants and Pesticides on Wading Birds.*

* This strategy is located in the Contaminants section of this document. However, it includes assessing effects of contaminants and pesticides.

Strategy PE-1 Maintain/Expand Pest Management Educational Efforts

Activities:

- Inventory existing programs.
- Increase pest management education for homeowners.
- Develop new practices based on research results.
- Focus educational efforts on the Pea Patch Island Heronry Region.

Participating Institutions:

- **Cooperative Extension Service**
- Delmarva Agrichemicals Association
- Delaware Department of Agriculture
- Delaware Department of Natural Resources and Environmental Control
- Farm Bureau
- Farm Services Administration
- Natural Resources Conservation Service
- New Jersey Department of Environmental Protection/Pesticide Control Program
- New Jersey Department of Agriculture
- Regional Conservation Districts
- Resource Conservation and Development Council

Schedule: Work will begin as soon as funding is obtained. Completion of Activities 1-3 could take up to two years. Activity 4 will become on-going, with periodic re-evaluations and modifications.

Cost: \$410,000.

Several programs and mechanisms for distributing up-to-date pest management information to appropriate audiences for the agricultural, residential pest management (including homeowners, professional lawn care services, pest control operators), rights-of-way maintenance services and commercial landscaping industries currently exist (additional highway, utility, plant site and industrial site programs could be developed). Much of this activity is accomplished through educational/technical seminars, workshops for professionals in both agricultural and commercial landscaping sectors, farm field days, newsletters, and pesticide applicator training and local meetings for farmers. The goal of this strategy is to incorporate information that comes out of the SAMP into existing programs that disseminate information about pest management practices throughout the community.

A prerequisite for Activities 3 and 4 will be the implementation of strategies C-2, C-4, C-5, and PE-2. The results of this work will help determine whether the birds are being exposed to toxic quantities of organochlorine, organophosphate and carbamate pesticides. This will be accomplished by measuring

contaminant levels in tissue (brain, liver, and kidney). Biological responses will also be studied in the field and prey samples will be analyzed for these pesticides.

Primary Activities

Activity 1: Inventory existing programs. Develop an inventory of existing educational programs for pest management. An active attempt to incorporate New Jersey conservation practices within the inventory will be essential.

Activity 2: Increase pest management education for homeowners. Increase pest management outreach programs concerning home lawn care and landscaping. Outreach education for homeowners can be addressed through community projects. Currently, Cooperative Extension is conducting a program in the Appoquinimink watershed that is funded by the Resource Conservation and Development Council. This program has been expanded to the Pike Creek Valley watershed. If funding becomes available, the watersheds within the 15-km radius of Pea Patch Island will be targeted for similar programs.

Activity 3: Develop new practices based on research results. Develop and integrate appropriate new pest management practices into existing programs if scientific research indicates that the health of the heronry is linked to pesticide exposure.

Activity 4: Focus educational efforts on the Pea Patch Island Heronry Region. Continue current pest management educational efforts and include presentations/information, which focus on the Pea Patch Island Heronry Region if research results show a need for additional concentration in this area. These efforts will target homeowners, the agriculture industry, landscape professionals, commercial property owners, the pest control industry and others.

Implementation

Institutional Responsibilities

The primary lead agencies for strategy implementation will be the Cooperative Extension Service, Natural Resources Conservation Service, and the Delaware Department of Natural Resources and Environmental Control and the Regional Conservation Districts. However, numerous other regulatory and local agencies will need to participate in the outreach development process for successful implementation.

Schedule

The estimated time for the completion of Activities 1-2 is 1 year. Activity 3 which will develop new pest management practices will take three or more years to complete. Educational programs are currently on-going and special Pea Patch Island presentations and future updates will be included in this effort as needed. See Table 9 for a summary of the proposed schedule.

Location

This strategy will focus primarily on the 15 km Pea Patch Island Heronry Region. Activity 3 will focus on the entire state of Delaware.

Costs and Funding

The anticipated cost of implementation for Activities 1-2 are \$100,000. These costs include labor, printing and publishing, and travel expenses. The cost of developing a new BMP (Activity 3) is estimated to range from \$150,000-300,000, depending on the issue and the extent of research required. Costs for outreach efforts which will emphasize the Pea Patch Island Heronry Region (Activity 4) are estimated to be \$10,000.

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

Funding for these activities will come from intergovernmental aid and education grants. See Table 9 for the cost and staffing resources required for each activity.

Performance Measures

Success of this strategy can be measured by homeowner surveys. Surveys will pose questions to homeowners which will determine whether pest management practices were implemented as a result of outreach activities and whether the practice was successful.

Strategy PE-1 -- Maintain/Expand Pest Management Educational Efforts

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Inventory existing programs.	CES	NRCS, DNREC, County Conservation Districts	8	✓	✓							10	0		In-kind	USDA, NRCS, CES
2. Increase pest management education for homeowners.	CES	NRCS, DNREC, County Conservation Districts	16		✓	✓	✓	✓				90	0			DNREC, CES, NRCS
3. Develop new practices as needed based on research results	CES	NRCS, DNREC, County Conservation Districts	28		✓	✓	✓	✓	✓	✓	✓	300	100			USDA, EPA, NRCS
4. Focus educational efforts on the Pea Patch Island Heronry Region.	CES	NRCS, DNREC, County Conservation Districts	16	✓	✓	✓	✓					10	10		In-kind	CES
Total Person Weeks = 68				Total Cost Quarters 1-8 = \$410,000												

Strategy PE-2 Determine Pesticide Use by Land Use

Activities:

- Develop a screening and sampling procedure for non-agricultural area pesticide use.
- Identify the agricultural contribution within 15-kilometer study area.
- Collect non-agricultural data.
- Edit and summarize data.
- Write final report.
- Evaluate the results and decide whether additional years of data are needed.

Participating Institutions:

- **Delaware Agricultural Statistics Service**
- Delaware Department of Agriculture
- Delaware Department of Natural Resources and Environmental Control
Delaware Coastal Management Program
- New Jersey Department of Environmental Protection
Pesticide Control Program
- New Jersey Department of Agriculture
- Cooperative Extension Service

Schedule: This strategy can be completed within one year of receiving funding.

Cost: \$37,000.

The objective of this strategy is to provide a more accurate assessment of the quantities of pesticides used in the foraging locations within the 15-kilometer study area. Specifically, any pesticides that may be identified in strategy C-5 as a “contaminant or pesticide of concern”. This strategy will be limited in scope to provide a pilot project that will assess pesticide use specifically within the *known* foraging locations in the study area. If the information identified through this strategy is found to be significant to the research on heron health, it will be expanded to other areas within the study area.

This strategy will identify and attempt to quantify pesticide usage from a variety of land uses within the study area. Manomet Center for Conservation Sciences will utilize this information for research into the health of the herons on Pea Patch Island.

Primary Activities

Activity 1. Develop a screening and sampling procedure for non-agricultural land uses. The Delaware Agricultural Statistics Service will develop a statistically sound procedure for screening and sampling the non-agricultural land uses within the study area.

Activity 2. Identify the agricultural contribution within 15-kilometer study area. Since there is a wealth of data on agricultural use of pesticides, this strategy will apply known application rates per acre to an inventory of crop acres in the target area. This portion of the strategy will yield known data based on land uses within the PPI region. (Note: This methodology will be significantly different from that used to collect non-agricultural data and there may be opposition to mixing methodologies.)

Activity 3. Collect non-agricultural data. The screening and sampling procedure developed in Activity 1 will determine if non-agricultural residents apply pesticides themselves or use a lawn care (commercial) company. The time of year that non-agricultural entities are surveyed will be considered to ensure the accuracy of the data collected. For residential land uses, if the resident applies the pesticides themselves, data will be collected from a statistically significant sample of those persons. For those using lawn care companies, the company name will be obtained and the application data will be collected from that firm for the target area. This procedure will provide approximations of pesticide use, not actual quantities of pesticides applied for non-agricultural land uses.

Activity 4. Edit and summarize data. All of the information obtained through the sampling and screening process will be edited and summarized for the various land uses identified. This data will be summarized for statistical soundness in order to determine the impacts from pesticide use in the 15-kilometer study area.

Activity 5. Write final report. A final report will be prepared which details the methods used to collect and analyze the data. In addition this report will outline the information collected on pesticide usage by land use category and provide an indication of the statistical soundness of the study.

Activity 6. Evaluate the results and decide whether additional years of data are needed. Once the final report is generated, the results will be evaluated and a determination will be made about whether additional years of data should be collected to get a more statistically sound estimate of pesticide use by landuse category.

Implementation

Institutional Responsibilities

The implementation of this strategy will be undertaken by the Delaware Agricultural Statistics Service which operates out of the Delaware Department of Agriculture. They will be the lead agency for this strategy. Support will be available from the University of Delaware's Cooperative Extension Service and the Delaware Coastal Management Program.

Schedule

It is estimated that this strategy can be completed in one year. The sampling and screening procedure can be developed and data collected for non-agricultural uses during the fall. The known data for the agricultural lands can be calculated and all of the collected data can be synthesized over the winter months. A final report can be produced within one year of obtaining funding. See Table 10 for a summary of the schedule for implementation.

Location

The strategy will be limited to the known heron foraging areas within the 15-kilometer study area.

Costs and Funding

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

The cost of this strategy is estimated to be \$37,000. Most of this cost is associated with staff time. See Table 10 for the costs and staffing resources associated with each strategy.

Funding sources for this strategy could be acquired through grants from the Pea Patch Island SAMP, Delaware §319 Program, or funds provided through the NRCS. The University of Delaware Cooperative Extension Service and the Delaware Coastal Management Program will provide support for this effort.

Performance Measures

The success of this strategy will be measured by the completion of a final report that meets the objectives set forth by the strategy.

Review/Key Decisions

The final report will be reviewed by the PPI SAMP Implementation Team. Based upon the findings of the report, the Implementation Team may decide upon key actions, which should result from the study, provided the on-going research with the birds indicates a link between pesticides and bird health.

Strategy PE-2 -- Determine Pesticide Use by Land Use

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Develop a screening and sampling procedure for non-ag area pesticide use.	USDA, DASS	DDA, DNREC, NJDEP, CES	2	✓								2	0		PPI SAMP, 319, NRCS	DNREC, DDA
2. Identify the ag contribution within 15 km study area.	USDA, DASS	DDA, DNREC, NJDEP, CES	6		✓							6	0		PPI SAMP, 319, NRCS	DNREC, DDA
3. Collect non-agricultural data.	USDA, DASS	DDA, DNREC, NJDEP, CES	15	✓								15	0		PPI SAMP, 319, NRCS	DNREC, DDA
4. Edit and summarize data.	USDA, DASS	DDA, DNREC, NJDEP, CES	6			✓						6	0		PPI SAMP, 319, NRCS	DNREC, DDA
5. Write final report.	USDA, DASS	DDA, DNREC, NJDEP, CES	4				✓					4	0		PPI SAMP, 319, NRCS	DNREC, DDA
6. Evaluate the results and decide whether additional years of data are needed.	USDA, DASS	DDA, DNREC, NJDEP, CES	4				✓	✓				4	0		PPI SAMP, 319, NRCS	DNREC, DDA
Total Person Weeks = 37				Total Cost Quarters 1-8 = \$37,000												

Strategy PE-3

Inventory Control Activities and Programs for Invasive Plants, Noxious Weeds, and Aquatic Plants

Activities:

- Develop a list of programs/activities.
- Identify known impacts of control programs on the heronry.
- Develop GIS coverage.
- Write final report.

Participating Institutions:

- New Castle Conservation District
- Delaware Department of Agriculture
- Delaware Department of Natural Resources and Environmental Control
Delaware Coastal Management Program
- New Jersey Department of Environmental Protection
- Delaware Department of Transportation
- New Jersey Department of Transportation

Schedule: Activities can be completed within one year of implementation.

Cost: \$18,000

The term “noxious weed” is defined as any species of plant or parts of plants, designated by the Delaware Department of Agriculture under Chapter 24, Title III of the Delaware Code, that adversely affect or threaten agricultural production. There are 4 noxious weeds regulated in Delaware: 1) Johnson grass, 2) Canada thistle, 3) bur cucumber, and 4) giant ragweed.

An invasive plant is any species of non-indigenous plant that is aggressive, spreads easily and out-competes other plant material in a habitat. Primary examples of invasive plants within the 15-km radius of Pea Patch Island are phragmites and purple loosestrife. Aquatic plants/weeds are defined simply plants that grow in water.

The objective of this strategy is to inventory and assemble a list of control activities and programs for invasive plants, noxious weeds, and aquatic weeds within the 15-km radius of Pea Patch Island. This strategy will also identify the known effects (positive and negative) of these activities on the heronry; including effects on birds, prey items and habitat and nesting site availability.

Primary Activities

Activity 1. Develop a list of activities and programs. A list of current control efforts, programs and activities for invasive plants, noxious weeds and aquatic weeds will be developed for both Delaware and New Jersey. Programs currently under development will also be included in this list. This task will be accomplished by surveying state agencies (DNREC, DelDOT, DDA, and New Jersey counterparts) and contacting commercial/industrial rights-of-way owners.

Contacts within Delaware state agencies and utilities are:

- 1) Noxious weeds: Don Eggen, DDA-Plant Industries Division
Forbes Darby, Delaware NERRS Intern
- 2) Aquatic weeds: Roy Miller or Kathy Martin for plant identification, DNREC-
Division of Fish & Wildlife;
- 3) Invasive plants: Bill Jones, DNREC-Division of Fish and Wildlife (Phragmites)
Contact in DDA or UD, (Purple Loosestrife)
- 4) DelDOT: Jill Lesley and Chip Rosen
- 5) Delmarva Power and Light: To be determined

Contacts in New Jersey:

- 1) NJDEP: Anne Witt
- 2) Public Service, Energy and Gas: Ingrid Ratsep

Activity 2. Identify known impacts of control activities on the heronry. Research will be done to identify the known effects of each of the plant control programs and activities on the heronry. Program literature and documentation will be examined in detail. A search of the public literature, national studies and any relevant published scientific articles will also be included in this research effort. Information gaps will be identified regarding data correlation to the birds, habitat, prey items and nesting sites.

Activity 3. Develop GIS coverages. GIS overlays for the 15-km radius around Pea Patch Island will be developed to show a) where these programs and activities are being implemented in both Delaware and New Jersey, b) locations of energy transmission lines and substations, and c) DOT right-of-way locations.

Activity 4. Write final report. A report will be written detailing the information gathered and the research performed to identify the known impacts of these activities. The report will address each step of the strategy, identify other informational needs, identify gaps that were found throughout the process, and address the strengths and weaknesses of the work approach.

Implementation

Institutional Responsibilities

The implementation of this strategy will be a coordinated effort. The New Castle Conservation District will take the lead in overseeing the project. DNREC and the Delaware Department of Agriculture will provide operational support. GIS support may be provided by NCCD or DCMP.

Schedule

This strategy can be complete within one year of the start date. For the preliminary schedule of activities, see Table 11.

Location

This strategy will focus on the 15-kilometer study area for the Pea Patch Island Heronry Region.

Costs and Funding

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

This strategy will require approximately \$18,000 for complete implementation. See Table 11 for costs and staffing resources associated with each activity.

Funding sources for this strategy could be acquired through grants from the Pea Patch Island SAMP (75%) and the cooperators willing to support the project (25%). The cooperators include: the DCMP, chemical manufacturers, and agencies sponsoring the activities and/or programs for control of invasive plants, noxious weeds, and aquatic plants.

Performance Measures

Success of this strategy will be based upon the completion of a final report that meets the objectives set forth by the strategy.

Review/Key Decisions

The final report will be reviewed by the PPI SAMP Implementation Team. Based upon the findings of the report, the Implementation Team will decide which key actions should result from the study of the invasive plants, noxious weeds, and aquatic plant control programs for Pea Patch Island.

Strategy PE-3 -- Inventory Control Activities and Programs for Invasive Plants, Noxious Weeds, and Aquatic Plants

Strategy PE-3 -- Inventory Control Activities and Programs for Invasive Plants, Noxious Weeds, and Aquatic Plants

Sediment and Fish Contaminant Evaluation Sites Pea Patch Island Heronry Region

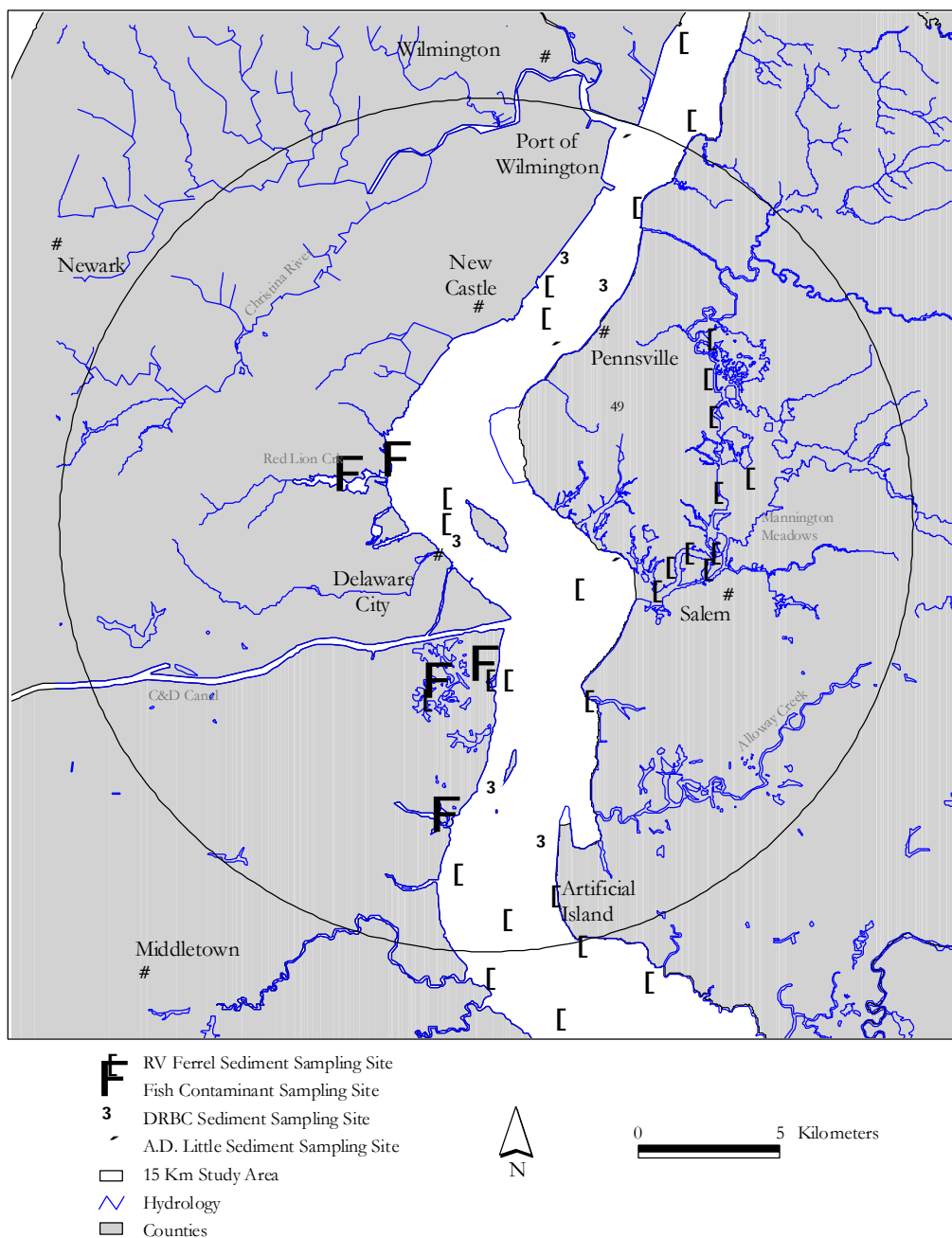


Figure 5. This map indicates sediment and fish sampling sites within the Pea Patch Island Heronry Region. The Island is located in the lower Delaware River, which has been influenced by contaminants resulting from years of anthropogenic activities upstream. Until recently, sampling efforts to determine contaminant levels in the region have been focused strictly on the river. Future efforts should be directed at wetlands adjacent to the river to determine contaminant levels within prime foraging areas. *Map created by the Delaware Coastal Management Program.*

CONTAMINANTS

Description

The second largest petrochemical refining industry in the United States lies northwest of Pea Patch Island along the coastlines of Delaware and Pennsylvania. The major shipping channel that supports this industry passes just 200 meters off the eastern side of the island. This shipping channel services the petrochemical industry in Delaware City, Delaware, and is the only route to ports located farther north. This channel also connects to the Chesapeake & Delaware Canal to the south. Along the New Jersey and Delaware coasts, there are extensive tidal wetlands and man-made impoundments. Farther inland, the land is used primarily for agriculture; however, in Delaware, this agricultural land is rapidly being consumed by housing developments.

Colonial wading birds use Pea Patch Island as a nesting site, and they seek food in surrounding areas of Delaware and New Jersey. Since agricultural, industrial, and residential land are potential foraging areas for these wading birds, they may also be a source of contaminants.

Exposure to contaminants on either an acute or chronic basis can produce lethal and sub-lethal effects in animals (Landis and Yu 1995). Pea Patch Island's location in the midst of many point and non-point sources of contaminants makes its heronry population susceptible to exposure. If indeed the population is experiencing exposure to contaminants, determining what they are and what levels may have an impact upon behavior, feeding, and ultimately, reproductive success are the questions that need to be answered.

When a contaminant is exposed to a living organism, it is either stored within the organism, metabolized by the body, or excreted. Chemicals not metabolized or excreted may build up over time through chronic exposure. This is typical of compounds that are fat soluble such as polychlorinated biphenyls (PCB's) and organochlorines such as DDT and DDE. When a contaminant is metabolized by an organism, the chemical structure is altered. This biotransformation may occur in the lung, kidney, intestine, or skin; however, this reaction most often occurs in the liver and is capable of causing cellular damage to the organ. The harmful biological effects from exposure to contaminants in vertebrates may result in: inhibition of oxidative metabolism and of the central nervous system; carcinogenesis; or injury to the reproductive system. Toxicants may disrupt or destruct cellular structure, combine with a cell constituent, or influence enzymes and initiate secondary actions that normally do not occur (Landis and Yu 1995).

Discussion

Indirect impacts. Sediment becomes contaminated when toxicants bind with sediment particles in the water column. The particles settle and become buried, effectively trapping them. The contaminants can become reintroduced into the water column if the sediments are re-suspended. Microorganisms and invertebrates that reside in bottom sediments are exposed to these contaminants. Small bottom feeding fish ingest these organisms, and the contaminants may be allowed to bio-accumulate in the fish if they are not excreted. Many of the species of birds that inhabit Pea Patch Island forage on the fish of the fringing Delaware River wetlands. Since these foraging birds are near the top of the food chain, the chances of contaminant bio-accumulation is greater along with the potential for lethal and sub-lethal effects.

Direct impacts. Although some contaminants accumulate in the organs and tissues of wading birds, the direct impacts of specific contaminants on wading birds is not well documented. There have been studies

**Pea Patch Island Heronry Region
Special Area Management Plan
July 1998**

performed primarily by the U.S. Fish & Wildlife Service, along with other agencies, on exposure and contaminant impacts to raptors and other birds. However, few studies directly examine exposure and impacts to wading birds specifically. The most complete foundation of contaminant impacts to birds and wildlife is documented in the USFWS *Contaminant Hazard Review Series* by Ronald Eisler. A more recent compilation of contaminants impacts on wildlife is *Environmental Contaminants in Wildlife, Interpreting Tissue Concentrations* by Beyer, Heinz, and Redmon-Norwood. Both of these sources have been used in this text to briefly evaluate the potential effects of contaminant exposure to wading birds.

Specific Contaminants of Concern

Specific contaminants of concern, that have been identified in preliminary blood and egg tissue analysis which are known to have negative impacts upon bird species have been outlined by Dr. Barnett Rattner, an Environmental Toxicologist from the U.S Geological Service at the Patuxent Wildlife Research Center, in Laurel, Maryland. The list of contaminants includes: Cadmium, Copper, Chlordane, Dieldrin, DDT, Endrin, Lead, Mercury, PCB's (12 Aerol Hydrocarbon Active Congeners), Selenium, and PAH's.

Potential Sources of Concern

Some toxins occur naturally in the environment, but at levels that are fairly insignificant to the health of the heronry's bird population. Anthropogenic sources of these substances are introduced to the Delaware Estuary through point and non-point sources. Point sources of discharge include industrial and municipal effluents. Non-point sources of pollution include agricultural and urban runoff, atmospheric deposition, and groundwater seepage.

Point Sources. Industrial effluent is a point source of concern because of the contaminants it most often contains (such as metals, PCBs, and PAHs) and because of the number of industrial effluent discharge facilities that are located within the region and immediately upstream. Industrial facilities located beyond the 15-km heronry region radius can have an impact upon the region via upstream discharges and upwind atmospheric loadings that eventually end up being deposited in the Pea Patch Island heronry region. Municipal effluent is also a point source which contains metals and PCBs. With the recent trend in growth within the region on the Delaware side, the amount of municipal effluent that is discharged is increasing.

Non-Point Sources. Non-point sources in the region include landfills, underground storage tanks, abandoned hazardous waste sites, urban and agricultural runoff, and dredge spoil disposal sites. Water quality tests for contaminants, such as metals and organic compounds, have been conducted since the late 1960s in the Delaware Estuary. Overall, the degree of contaminants detected in water quality samples has declined since the 1970s. There is a concern, however, for levels of these contaminants that do not exceed the established water quality criteria but may have the potential to bio-accumulate over time. It is estimated that, in 1995, the total toxic substance loadings for the Delaware Estuary was a minimum of 1,000,000 kg/yr (Sutton, Herron, and Zappalorti 1996).

Since 1993, the Manomet Center for Conservation Sciences and the Delaware Department of Natural Resources & Environmental Control have conducted research on the birds of Pea Patch Island. In the 1995 study, Black Crown Night Heron eggs were collected for analysis, along with samples of catfish from known foraging marshes. Organochlorines that were detected in the analysis of Black Crowned Night Heron eggs include oxychlordane, heptachlor epoxide, trans-nonachlor, Aroclors 1254 and 1260, p,p'DDE, cis-nonachlor, p,p' DDD, and Dieldrin. Elements that were also detected include aluminum, copper, iron, mercury, magnesium, manganese, selenium, strontium, zinc, barium, and molybdenum (Parsons 1996). Eggshell thickness was also measured and had a 7% thinner average than pre-DDT era eggs. Composite samples of bullhead catfish were taken from surrounding marshes of the Island where the birds are known to forage. These tests indicated that organochlorines such as: p, p' DDT, Aroclor 1260 and metals copper, lead, mercury, manganese, selenium, and zinc were present in these catfish samples.

Manomet Center will continue with their research and biomonitoring data of the heronry to supplement the existing data and provide information that is necessary in order to evaluate if these contaminants of concern are impacting the health of the Pea Patch Island Heronry and its supporting natural resources.

Recommended Targets and Strategies

Five targets were developed by the Contaminants Group at the Issue Characterization Workshop in December, 1996. These targets are described in the *Pea Patch Island Special Area Management Plan: Issue Characterizations*. Descriptions for thirteen management strategies to address these targets were developed during and immediately after the Strategy Development Workshop in April 1997. A subset of six strategies was identified to be moved forward in the process for more refined thinking and description of implementation details. The strategies being addressed in the SAMP are:

- C-1** Evaluate and Assess Impacts of Confined Disposal Sites Within the 15 Kilometer Foraging Area.
- C-2** Establish and Implement Sediment and Water quality Criteria for Avian Species.
- C-3** Establish a Consistent Interstate Framework and Information Management System for Dredging Decision-Making.
- C-4** Target Pollution Prevention at Industries That Release Contaminants of Concern.
- C-5** Assess Effects of Industrial Contaminants and Pesticides on Wading Birds.
- C-6** Prioritize Hazardous Waste Sites for Clean-Up According to Wading Bird Usage.

Strategy C-1 Evaluate and Assess Impacts of Confined Disposal Sites Within the 15 km Foraging Area

Activities:

- Determine usage and benefits of confined disposal facilities for avian species.
- Define the operations and maintenance of confined disposal facilities within the 15 km radius.
- Assess impacts and identify options for minimum contaminant exposure.
- Implementation and monitoring.

Participating Institutions:

- Delaware Department of Natural Resources & Environmental Control
- Army Corps of Engineers
- Delaware River Basin Commission
- Manomet Center for Conservation Sciences
- Star Enterprises
- New Jersey Department of Environmental Protection
 - Office of Program Coordination
 - Dredging Task Force

Schedule: Work can begin as soon as funding is obtained. Activities 1-3 can be completed within a year and a half. Monitoring associated with Activity 4 will become on going.

Cost: \$27,000.

Pea Patch Island is located in a region which is heavily used by industry and which supports several large cities. Because of the heavy industry in the area, material that is dredged from the Delaware River in this region is likely to contain contaminants. Confined upland disposal facilities for dredged materials are sources and sinks of contaminants and thus may be a direct source of contamination to birds that use these areas for foraging. The operation and maintenance of these facilities can make contaminants that are isolated in river bottom sediments available to wader birds. Increased contaminant availability may occur during active dredging (i.e. effluent) or during the years in between material placement and site use.

The goal of this strategy is to evaluate the operation and maintenance of confined disposal facilities and their potential for release and containment of contaminated material, to determine wading bird usage at these facilities, and to determine any associated exposure impacts.

Primary Activities

Activity 1. Determine usage and benefits of confined disposal facilities for avian species. Monitor and identify confined disposal facilities that have the potential for utilization by moderate concentrations of foraging wading birds. Determine the conditions which are conducive to use by wading birds (i.e. exposed mudflat, first year vegetative growth, or phragmites cover).

Activity 2. Define the operation and maintenance of confined disposal facilities within the 15 km radius. This activity will involve an investigation into the operations of the confined disposal facilities within the 15 km radius of Pea Patch Island. Things that will be investigated include: the frequency of disposal activities, rates of material being pumped, quality of material being disposed of (i.e. degree of contamination), and mass loadings in and out of the facility. This assessment could be contracted out.

Activity 3. Assess impacts and identify options for minimum contaminant exposure. Create a working group to evaluate the assessment report produced in Activities 1 and 2. This group will identify and develop alternatives to any problem areas that will reduce the potential for impacts to birds and minimize contaminant reentrance into the river.

Activity 4. Implementation and monitoring. Implement recommendations from Activity 3 and monitor for improvement at appropriate sites.

Implementation

Institutional Responsibilities

The implementation of this strategy will be led by DNREC and the Corps of Engineers, with support from DRBC, and Star Enterprises. Activities 1 and 2 will be contracted out for an assessment report. Participation by the state of New Jersey will be essential for the implementation of this strategy in Salem County.

Schedule

Work on Activity 1 can begin as soon a funding is made available. The time needed for completion of a report is one and a half years. Activity 2 could be initialized in the spring of the year, preferably while Activity 1 is still being carried out. It will take several months to convene the working group and get results for Activity 3. Activity 4 will become a long term project in the area of monitoring on 3-5 year basis. See Table 12 for a summary of the schedule for this strategy.

Location

This strategy will focus on upland confined dredged material disposal facilities within New Castle County, Delaware and Salem County, New Jersey. The majority of these sites are located directly adjacent to the Delaware River and wetland foraging areas.

Costs and Funding

Activity 1 will include fieldwork most likely contracted out to Manomet Observatory for the spring/summer breeding season. The costs for this field season will probably range around the salary of one full time employee (FTE). Activity 2 could be contracted out to an environmental firm that is familiar with dredging and the region. Costs for a complete study could range around \$22,000. Activity 3 will require mostly staff resources at a cost of \$5,000. Costs for activity 4 will be dependent upon the recommendations made in Activity 3. See Table 12 for costs and staffing resources associated with each activity.

Performance Measures

Success of this strategy will be determined by a reduction of contaminant loading out of confined disposal sites and by a better understanding of wading bird use of confined disposal sites.

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

Review/Key Decisions

There must a clear understanding of the operations and maintenance done by the Army Corps of Engineers at disposal sites and the type of material that is put into them. This strategy must also determine wading bird usage at these sites before implementation.

TABLE 12**Strategy C-1 -- Evaluate and Assess Impacts of Confined Disposal Sites Within the 15 km Foraging Area**

Primary Activity	Proposed Lead	Primary Support	Person Weeks	Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
				1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Determine usage and benefits of confined disposal facilities for avian species.	DNREC	Manomet, USACE	20	✓	✓							10	0		✓	DCMP, USACE
2. Define operations and maintenance of confined disposal facilities within the 15 km radius.	DNREC	USACE, Contractor	12	✓	✓	✓	✓					12	0		✓	DCMP, USACE
3. Assess impacts and identify options for minimum contaminant exposure.	DNREC	DRBC, Ports, Star, NJDEP, USACE	5				✓					5	0		✓	DCMP, USACE
4. Implementation and maintenance.	DNREC	USACE						✓	✓			Unknown	Unknown		✓	DCMP, USACE
Total Person Weeks* = 37				Total Cost Quarters 1-8* = \$27,000												

* does *not* include estimates for activity 4

Strategy C-2

Establish and Implement Sediment and Water Quality Criteria for Avian Species

Activities:

- Identify levels of contamination for prey items at various trophic levels.
- Identify data gaps for various trophic levels and obtain data.
- Identify sources of available information, determine sampling strategies to address gaps for site specific data, and conduct sampling.
- Develop a bioaccumulation model to describe trophic transfer of contaminants.
- Establish appropriate criteria based upon bioaccumulation model results.

Participating Institutions:

- Delaware Department of Natural Resources & Environmental Control
- New Jersey Department of Environmental Protection
 - Office of Program Coordination
 - Dredging Task Force
- U. S. Fish & Wildlife Service
- United States Environmental Protection Agency
- Manomet Center for Conservation Sciences
- Delaware River Basin Commission

Schedule: Start date and length of activities will be dependent upon results from strategy C-5, "Assess Effects of Industrial Contaminants and Pesticides on Wading Birds." Activities will take 2-4 years for completion.

Cost: \$100,000 - 1,000,000.

Water quality criteria have traditionally been based on human health concerns. For some contaminants, these criteria may not be strong enough to ensure protection of avian species within the Pea Patch Island Heronry Region. Although sediment criteria do exist based on effects to fish and benthos, there are few sediment and water quality criteria for other wildlife species.

The intent of this strategy is to establish appropriate criteria, based on acceptable levels in avian species, to reduce pollutant concentrations in the Pea Patch Island environment. These criteria will be dependent upon the data and results from strategy C-5. The steps taken in developing sediment and water quality criteria will be based upon the effects levels found in strategy C-5. The degree of effect will determine whether or not legally enforceable criteria or ecotoxicological guidelines will be established.

If the effects from strategy C-5 are found to be serious, the timing and costs associated with carrying out Activities 1-5 listed below will be cumbersome; however, establishing legally binding sediment and water quality criteria for the protection of avian life would be beneficial on a local and national basis, and could outweigh other constraints. Undertaking an elaborate process to understand which contaminant

concentrations in the trophic web will effect the avian population will ultimately provide for strong, legally defensible protective criteria. If effects are found, but not at alarming levels, criteria could be developed alternatively using Activities 1, 2, and 3, listed below. This method would not be as comprehensive but would provide guidelines based upon NOELs (No Observed Effects Levels) and LOELs (Lowest Observed Effects Levels) and would determine reference dosages for ecotoxicological guidelines aimed at avian health.

Primary Activities

Activity 1. Identify levels of contamination for prey items at various trophic levels. List and review avian species prey items at Pea Patch Island, distinguishing between upland, wetland, and upland/wetland feeders. List the identified contaminants of concern. Characterize the food web indicating amount of prey species being consumed (including year class and size of prey), what the contaminant residue levels are in the tissues of prey, and bird growth rates.

Activity 2. Identify data gaps for various trophic levels and obtain data. Identify data gaps from Activity 1 at all trophic levels and fill in with available data and information (via literature search of previous studies).

Activity 3. Identify sources of available information, determine sampling strategies to address gaps for site specific data, and conduct sampling. Define the sampling strategy, area, and the number of samples needed to adequately characterize contaminant levels and data gaps. Conduct field sampling identified in Activity 2.

Activity 4. Develop a bioaccumulation model to describe trophic transfer of contaminants. Analyze data collected in Activities 1-3 and incorporate data into the development of a bioaccumulation model to demonstrate the trophic transfer of contaminants. This bioaccumulation model will indicate acceptable levels of contaminants in water and sediment for avian species. A separate independent fate and transport model will be used in the bioaccumulation model to factor in the movement of contaminants independent of biological processes, i.e. sediment and water transport from the source.

Activity 5. Establish appropriate criteria based upon bioaccumulation model. Use the bioaccumulation model results to develop appropriate criteria for acceptable levels in avian species. This activity will include representatives from the Delaware River Basin Commission, Delaware Department of Natural Resources and Environmental Control, New Jersey Department of Environmental Protection, EPA, Manomet, and the US Fish & Wildlife Service.

Implementation

Institutional Responsibilities

The primary lead for implementation will be DNREC with support from Manomet Center, USFWS, and the Delaware River Basin Commission. Activities 3 and 4 will be performed by contractors with oversight of agencies.

Schedule

Depending upon findings in C-5, this strategy could take up to 5 years if Activities 1-5 are completed in full. If the alternative of Activities 1 and 2, and 3 were chosen it would take 1 1/2 - 2 years for completion.

Existing programs

There are existing programs such as the NPDES programs, which utilize criteria to establish Total Maximum Daily Loadings (TMDLs).

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

Location

All data collection and fieldwork will be done at Pea Patch Island and the surrounding foraging areas. Implementation of the strategy will be related back to the source identification. In particular, this includes New Castle County, Salem County, Delaware River, and site specific point sources.

Costs and Funding

This strategy will require approximately \$1,000,000 if all 5 activities are carried out to their fullest extent. Capital costs for alternative 1 (Activity 3) will be approximately \$80,000. This includes a workstation to run the model. Other costs for alternative 1 include contractual work for lab work and analysis and staff time to perform tasks.

Performance Measures

Success of the strategy will be measured by a reduction in loads of contaminants of concern and increased avian reproduction and survivability. The island will be monitored every 3-5 years to determine whether improvements are occurring in response to controls. It will take significant time for improvements in sediment and water quality to be manifested by the Pea Patch Island avian population. Actual reductions in loadings would be determined by monitoring of sources.

Review/Key Decisions

Existing programs and authorities that will need to be encompassed in review and decision making are; Delaware River Basin Commission, Delaware Department of Natural Resources and Environmental Control, New Jersey Department of Environmental Protection, EPA, Manomet, and the US Fish & Wildlife Service.

Strategy C-2 -- Establish and Implement Sediment and Water Quality Criteria for Avian Species

Strategy C-2 -- Establish and Implement Sediment and Water Quality Criteria for Avian Species

Strategy C-3

Establish a Consistent Interstate Framework and Information Management System for Dredging Decision-Making

Activities:

- Conduct workshop on existing dredging policy framework.
- Revise and implement the dredging policy framework.
- Conduct a second workshop to address problems associated with informational needs.
- Develop a supporting information management system.

Participating Institutions:

- **Delaware Department of Natural Resources & Environmental Control**
(DCMP, DFW, DWR, DSWC)
- New Jersey Department of Environmental Protection
Office of Program Coordination
Dredging Task Force
- Pennsylvania Department of Environmental Resources
- Army Corps of Engineers
- Environmental Protection Agency
- Fish & Wildlife Service - Delaware Bay Estuary Program
- National Marine Fisheries Service
- National Oceanic & Atmospheric Administration
- Delaware River Basin Commission
- Port Authorities
- Mid-Atlantic Fisheries Management Council

Schedule: Work could begin as soon as funding is obtained. Project completion could take 1-2 years.

Cost: \$60,000.

On a yearly basis, maintenance and new dredging projects that occur within the Pea Patch Island Heronry Region encompass large quantities of dredged material. Dredging in this area is necessary in order to provide access for maritime traffic to ports and recreational activities. The shipping traffic that uses the Delaware River and Bay Main Channel, the Chesapeake and Delaware Canal, and the Salem River Channel are vital to the regional economy. For this reason these channels are continuously maintained at depth.

Various state and federal agencies review dredging projects, most often on an independent basis. This individual review process can be incomplete for addressing potential cumulative and secondary impacts. The establishment of this framework would bring together all of the regulatory agencies and affected parties to outline a comprehensive review method for addressing environmental cumulative and secondary impacts. At the same time, a desk-top information management system with all relevant spatial and non-spatial data will

be developed. This information system is necessary due to the large amount of information associated with these projects. This system will be needed in order to conduct an extensive comprehensive review of individual projects.

Primary Activities

Activity 1. Hold workshop on existing dredging policy framework. Conduct a structured workshop with federal and state regulators aimed at fine tuning an already existing dredging policy framework. Workshop participants would be asked to define the problems and/or needs associated with dredging issues and the regulatory review of dredging projects. The problem descriptions would be thoroughly detailed for review by national experts. The goal of restructuring this framework would be to structure coordinated agency reviews of dredging projects. Components of the framework would include: applicability, regulatory authorities, standard testing methodologies, agency review coordination, dredged material placement guidelines, contaminant level thresholds, beneficial use options, confined upland disposal options, review of cumulative and secondary impacts, economic concerns, and possibly the establishment of a local/regional dredging team to ensure proper use of the framework.

Activity 2. Revise and implement dredging policy framework. Incorporate information obtained at workshop 1 into a revised dredging policy framework for review by workshop participants. After review and approval, agreements would be made to uphold the policy framework and establish a local/regional dredging team that would ensure coordinated reviews. This team would meet on an as needed basis to carryout project reviews.

Activity 3. Conduct second workshop to address problems associated with informational needs. Conduct a second workshop utilizing the revised dredging policy framework to address the informational problems (identified at the first workshop) associated with review of dredging projects. Participants would include members from the local/regional dredging team, affected parties, experts in the dredging field and GIS, and regulators. The task of participants would be to design the information management system requirements by identifying known problems and concerns along with solutions and/or alternatives. The structure of the information management would be designed to effectively implement the framework review process.

Activity 4. Develop a supporting information management system. Utilize information collected at both workshops to develop a customized system that will support the decision-making needs of the dredging policy framework.

Implementation

Institutional Responsibilities

The primary lead agency would be the Delaware Coastal Management Program for strategy implementation. However, numerous other agencies regulatory agencies (DNREC-DWR, DFW, DSWC, NJDEP, PADEP, EPA, USACE, USFWS, MAFMC) would need to participate in the two workshops for successful implementation.

Schedule

Work could begin as soon as funding becomes available. The estimated time for completing this strategy from start to finish would be 1-2 years.

Location

This strategy would focus on the Delaware River and Bay, Salem River, C&D Canal, and nearby tributaries within the Pea Patch Island Heronry Region.

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

Costs and Funding

The anticipated costs of implementation would be \$60,000. Anticipated funding would come from intergovernmental aid.

Performance Measures

Success of this strategy will be measured by completion of a formal interagency Memorandum of Agreement for implementation of the policy review framework and an approved dredging policy framework. Successful strategy completion will also result in a consistent, predictable approach to project review, expedited dredging project review and reduced cumulative impacts from dredging projects.

Strategy C-3 -- Establish a Consistent Interstate Framework and Information Management System for Dredging Decision Making

Strategy C-3 -- Establish a Consistent Interstate Framework and Information Management System for Dredging Decision Making

Strategy C-4 Target Pollution Prevention at Industries that Release Contaminants of Concern

Activities:

- Identify contaminants of concern.
- Identify industries and businesses that release contaminants of concern.
- Contact industries and businesses to offer technical assistance.
- Implement technical assistance.

Participating Institutions:

- Delaware Department of Natural Resources & Environmental Control
- New Jersey Department of Environmental Protection
- New Castle County Government
- Salem County Government
- Industrial Associations

Schedule: Work could begin as soon as contaminants in strategy C-5 are identified. Activities 1 - 3 could take up to one and a half years to complete. Activity 4 will be implemented after completion of Activities 1-3 and could become ongoing.

Cost: \$35,000

To supplement current regulatory efforts by state implemented NPDES, RCRA, TCEA, and Pollution Prevention programs, technical assistance should be provided to targeted industries and businesses in order to reduce discharges of contaminants of concern into the Pea Patch Island Heronry Region. This strategy's implementation will be dependent upon Strategy C-5 "Assess Effects of Industrial Contaminants and Pesticides on Wading Birds" and its findings related to contaminants of concern. If findings from C-5 are found to be inconclusive, this strategy still could be implemented as a preventative measure using the list of "contaminants of concern" listed in the Pea Patch SAMP Issue Characterization Document.

Primary Activities

Activity 1. Identify contaminants of concern. Identify the contaminants of concern to focus on based upon the findings from strategy C-5. These findings should be presented to the Delaware River Basin Commission's/Delaware Estuary Program's Toxics Advisory Committee in order to add new contaminants of concern to their existing list or to give those already listed priority status.

Activity 2. Identify industries and businesses that release contaminants of concern. Identify industries and businesses that discharge, generate, or store contaminants of concern listed in Activity 1. This task will involve looking

at state implemented NPDES programs to identify what is being discharged, RCRA programs for what they generate, and TCEA programs for what they store and use.

Activity 3. Contact industries and businesses to offer technical assistance. Contact industries and businesses listed in Activity 2 and identify those who would accept volunteer technical assistance. Vehicles for outreach to industry could include NJ Technical Assistance Program, state Pollution Prevention Programs, the Delaware Manufacturing Alliance, and non-profit groups such as the Partnership for the Delaware Estuary.

Activity 4. Implement technical assistance. Part of this implementation process will involve offering incentives and some sort of recognition program for those who participate. The development of individual pollution reduction programs will consider factors such as the industry, the chemicals of concern, the processes they utilize, and storage and handling requirements of each chemical. These pollution reduction programs will be implemented at the participating industries and businesses.

Implementation

Institutional Responsibilities

The Delaware Department of Natural Resources & Environmental Control and the New Jersey Department of Environmental Protection (and their associated permitting and pollution prevention programs) will be the lead agencies in the implementation of this strategy. Other supporting institutions will include counties, technical assistance programs, and large industrial associations.

Schedule

Once the contaminants of concern are identified, Activities 2 and 3 will take up to 1-11/2 years. Activity 4, implementation, could become an ongoing task that will be modified as technology changes and upgrades are made. See Table 15 for the proposed schedule by activity. The schedule will ultimately depend on the potential long term funding and needs of this strategy.

Location

This strategy will focus on the Pea Patch Island Heronry Region and foraging ranges in New Castle County, Delaware and Salem County, New Jersey. Actual implementation of technical assistance will be at the site specific targeted industries and businesses.

Costs and Funding

This strategy will require approximately \$35,000 in labor costs to implement. The main costs for Activity 3 and 4 would be for staff time. See Table 15 for costs and funding sources associated with each activity in this strategy.

It is anticipated that funding could be obtained through grants like: EPA Sustainability Challenge Grant, EPA Pollution Prevention Grants, § 319 Grants, and the Delaware Estuary Program Grants.

Performance Measures

The success of this strategy will be measured by reduced discharges of the identified contaminants of concern within the 15 kilometer Heronry Region. This will be measured through NPDES permitting and the number of businesses that participate. A greater understanding and awareness of the SAMP, the heronry, and the regions natural resources by the industries and businesses in the region. This strategy could be a starter program for a larger statewide project.

Review/Key Decisions

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

Review of this strategy and key decision making should be conducted by the states of NJ and DE.

Strategy C-4 -- Target Pollution Prevention at Industries that Release Contaminants of Concern

Strategy C-4 -- Target Pollution Prevention at Industries that Release Contaminants of Concern

Strategy C-5

Assess Effects of Industrial Contaminants and Pesticides on Wading Birds

Activities:

- Quantify contaminant exposure.
- Monitor birds for exposure effects (biochemical to population level responses).
- Establish links between exposure and effects through statistical analysis.
- Establish causality through controlled laboratory studies.
- Develop, implement and monitor success of management actions (as needed).

Participating Institutions:

- **Manomet Center for Conservation Sciences**
- Delaware Department of Natural Resources & Environmental Control
- Patuxent Wildlife Research Center - US Department of the Interior

Schedule: Activities began in spring of 1997. Analyses of samples collected and data synthesis could extend into 1999. Mitigation and monitoring will be ongoing.

Cost: One time cost of \$50,000 for organochlorine analyses. Anticipated annual costs of \$200,000 (1998-2000); monitoring costs are \$50,000 a year.

This strategy will assess the significance of exposure of contaminants and pesticides to wading birds. Priority contaminants include organochlorines, toxic metals and cholinesterase-inhibiting insecticides. This strategy will establish the relationship (both correlative and causal) between exposure and effects (or lack of). A broad spectrum of effects will be assessed including biochemical, physiological, immunological, reproductive and population level responses. Exposure will be assessed using residue data from biological tissues (stomach contents, blood, egg, brain). Methods to quantify effects include biomarker studies (e.g. induction of liver enzymes), field assessments of reproductive competence, and population modeling. The objective of this strategy is to examine and document adverse effects ("damage") to wading birds that can be directly or indirectly related to contaminant exposure.

Aside from their ecological role in estuaries, aesthetic value and consumptive use as a natural resource, many species of birds have served as excellent monitors of environmental pollution. Wading birds in particular have been used for biomonitoring potentially contaminated wetlands and estuaries owing to their high trophic level, tendency to bioaccumulate pollutants, widespread distribution, nest site fidelity, and synchrony of nesting. Numerous field studies have clearly documented contaminant exposure and associated toxicological effects through measurement of pollutant burdens, biochemical responses, histopathological lesions, teratogenesis, genetic damage, altered reproductive success, and impaired growth of young. For some contaminants, cause-effect relationships for molecular through organismal relationships have been established to the population level (e.g. DDE, Pb, Se).

The strategy is a prerequisite for implementation of strategies C-1, C-2, C-3, C-4, C-6, PE-1 and PE-3. Activities 1-3 began in the 1997 field season building upon baseline data collected during 1993-1996. The

results of this work will help determine whether wading birds are being exposed to toxic quantities of organochlorines (including PCBs and chlorinated pesticides such as DDT), heavy metals, and cholinesterase-inhibiting insecticides (organophosphates and carbamates). Contaminant levels will be measured in brain, liver, kidney, egg and blood tissues, as well as in wading bird prey items. Biological responses will be measured in laboratory assays and in the field. Activities 4-5 will depend on whether evidence of adverse exposure is found.

The anticipated impacts from implementing this strategy are manifold. Information on the ecotoxicological status of Pea Patch Island's wading birds will help wildlife managers protect the region's natural resources through informed monitoring. If impacts to birds are found to be unacceptable, focused mitigation measures that are cost- and time-effective can be developed with science-based information. If mitigation measures call for reduced contaminant inputs from point- and non-point sources, economic burdens may be borne by industry, agriculture and the public.

Primary Activities

Activity 1. Quantify contaminant exposure. Conduct surveys to quantify exposure of wading birds and their food items to various pollutants (e.g. organochlorine pesticides, PCBs including coplanar congeners, heavy metals, organophosphorus, and carbamate insecticides). This will be accomplished through measurement of various pollutant concentrations and biomarker responses in eggs, nestlings, juveniles, and adults. These surveys will include measurement of *Ah*-receptor active PCB congeners, cytochrome P450, oxidative stress, and liver histopathology, measurement of brain cholinesterase activity and chemical residues, accumulation rates and histopathology of liver and kidney in nestlings and young birds, and reactivation analysis of serum cholinesterase. Results from the 1997 field season may require that additional analyses be conducted during subsequent field seasons.

Activity 2. Monitor birds for exposure effects. Closely monitor individual birds at their nesting and foraging areas for evidence of adverse behavioral, biochemical, immunological, physiological, and morphological responses indicative of contaminant exposure and effects. These may foreshadow effects at higher levels of biological organization. Biomarker responses are examples of biochemical effects. Eggshell thinning and histopathological effects are examples of physiological changes that may occur in response to contaminant exposure. Monitoring tasks would involve assessing reproductive success of marked nests, video taping of behavior at study nests and quantifying fledgling survival through telemetry. Responses at Pea Patch Island and a concurrent reference site will be documented. Documentation of these population level responses involves weekly checks at study nests.

Activity 3. Establish links between exposure and effects through statistical analysis. Establish a relationship between contaminant exposure and effects. This will involve statistical analysis and interpretation of the data collected in Activities 1-2. Interpretation will utilize established protocols in the scientific literature.

Activity 4. Establish causality through controlled laboratory studies. If effects can be associated with contaminant exposure, attempt to establish causality through controlled laboratory studies with forage material collected from feeding areas in close proximity to Pea Patch Island. Monitor reproductive success of those birds reared in captivity. This could be accomplished with a breeding colony, or with artificially incubated eggs and rearing of hatchlings with natural forage material or an extract of forage material mixed into feed. Such a controlled study would minimize influences of weather, predation, disease, and food availability. It would also help to pinpoint whether influencing factors are extrinsic or intrinsic.

Activity 5. Develop, implement, and monitor success of management actions. Assuming contamination has been documented, this activity focuses on long term management. After appropriate management actions, monitor at fixed intervals reproductive success of several species of free ranging wading birds at Pea Patch Island to

**Pea Patch Island Heronry Region
Special Area Management Plan
July 1998**

document success or failure of habitat remediation. Pollution prevention guidelines may need to be established. Dissemination of results will be made to the Core Group, Research Advisory Committee, and appropriate scientific and public audiences.

Implementation

Institutional Responsibilities

Manomet Center for Conservation Sciences and Patuxent Wildlife Research Center will champion this strategy. DNREC will assist with implementation and coordination. Manomet and DNREC will seek funds for research and monitoring. The SAMP Research and Biomonitoring Advisory Group, composed of scientists from government, industry and academia will advise and assist with plan development.

Schedule

Activities 1-2 have been initiated with several years of baseline data for comparison. However, these studies have been significantly expanded for enhanced analysis. Field work for Activities 1-2 will continue for the 1997 and 1998 field seasons. Depending on the results from Activities 1-2 and the analysis in Activity 3, the schedule for Activities 4 and 5 will be determined, both involve long term commitments. See Table 16 for the projected schedule according to activity.

Location

All data collection and field work will be done at Pea Patch Island and the birds' foraging areas, along with collection at reference nesting sites and foraging areas. These geographical areas include New Castle County, Salem County, Delaware River, Uplands, Wetlands, Sussex County and Rehoboth Bay.

Costs and Funding

This strategy will require approximately \$250,000 in capital costs and labor to implement initially. Annual costs for Activities 1-4 will cost approximately \$200,000. It is anticipated that information development will be completed by 2000 and implementation of management actions (if warranted) will become the primary activity of this strategy at that time. Costs to implement and monitor management actions are unknown. See Table 16 for the costs associated with each activity.

Financing of this strategy is anticipated to come from both intergovernmental aid and private capital grants and in-kind services. Potential state government sources include DEP, \$6217, and \$319.

Performance Measures

The performance measures of this strategy will include: sustained improved reproduction, improved habitat quality, a better understanding of the relative role of environmental pollutants on wading bird reproductive success, and sustainability of the colony. The results of Activities 1 through 5 will be subject to peer review and submitted for publication in the scientific literature. The Research and Biomonitoring Advisory Group will be reconvened prior to initiating this strategy.

Review/Key Decisions

Existing programs and authorities that will need to be encompassed in review and decision making are; Delaware Department of Agriculture, Delaware Department of Natural Resources and Environmental Control, Patuxent Wildlife Research Center (USGS-Department of the Interior), Manomet Center, and the US Fish & Wildlife Service.

TABLE 16

Strategy C-5 -- Assess Effects of Industrial Contaminants and Pesticides on Wading Birds

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Quantify contaminant exposure.	Manomet	Patuxent, DNREC	104	✓	✓	✓	✓	✓	✓	✓	✓	125	0	✓		DCMP, Patuxent, DNREC
2. Monitor birds for exposure effects.	Manomet	Patuxent, DNREC	104	✓	✓			✓	✓			100	0	✓		DCMP, Patuxent, DNREC
3. Establish links between exposure and effects through statistical analysis.	Manomet	Patuxent, DNREC	52		✓	✓	✓		✓	✓	✓	125	0		\$ 319, \$ 6217	DCMP, Patuxent, DNREC
4. Establish causality through controlled lab studies.	Manomet	Patuxent, DNREC	52						✓	✓	✓	50	0		\$ 319, \$ 6217	DCMP, Patuxent, DNREC
5. Develop, implement and monitor success of management actions.	DNREC		52							✓	✓	50	50		\$ 319, \$ 6217	DCMP, Patuxent, DNREC
Total Person Weeks = 364				Total Cost Quarters 1-8 = \$450,000												



✓ = this activity is underway or has already been completed

Strategy C-6

Prioritize Hazardous Waste Sites for Clean-up According to Wading Bird Usage

Activities:

- Obtain the National Priority List (NPL), State, and Resource Conservation Recovery Act (RCRA) hazardous waste sites within the 15 km radius.
- Identify sites with habitat risks and contaminants of concern.
- Conduct literature search.
- Determine projected clean-up schedule.
- Finalize list.
- Determine usage of sites by wading birds.
- Rank/prioritize sites for clean-up.

Participating Institutions:

- US Fish & Wildlife Service
- US Environmental Protection Agency-Regions II & III
- New Jersey Department of Environmental Protection
- Delaware Department of Natural Resources & Environmental Control

Schedule: Estimated completion time for this strategy is approximately one year.

Cost: \$30,000.

Contaminants from hazardous waste sites may cause adverse effects to wading birds through food and/or sediment ingestion. The 1997 field research results from strategy C-4.1 “Assess Effects of Industrial Contaminants and Pesticides on Wading Birds”, should indicate what specific contaminants of concern the birds are being exposed to. This strategy should not depend upon research results solely; this should be done as a least regret activity. A prioritization scheme of hazardous waste sites that contain these contaminants of concern and are actively used by birds from Pea Patch Island is recommended so that risks to wading birds are addressed as part of the site remediation plans.

Primary Activities

Activity 1. Obtain list of NPL, state, and RCRA hazardous waste sites within the 15 km radius. Contact EPA regions III and II and obtain the Federal National Priority List and contact NJ and DE State programs to obtain state sites. These lists should include the Remedial Project Managers name and indicate the sites that have been delisted, closed or cleaned-up.

Activity 2. Identify sites with habitat risks and contaminants of concern. Contact site managers at sites located within the 15 km heronry region. Prepare and distribute a questionnaire to be answered by remediation site

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

managers that will help determine if there are habitats at risk at these sites, if they are utilized by wading birds, and what the potential exposure and toxicity may be with the known contaminants at each site.

Activity 3. Conduct literature search. Conduct extensive literature search on contaminants that may be a hazard to birds that are found at the sites with desirable wading bird habitats.

Activity 4. Determine projected clean-up schedule. Determine projected clean-up schedule of sites identified in Activity 2 and identify those that will be remediated in the near future and those that will not.

Activity 5. Finalize list. Produce a list of sites using information from Activities 1-4 indicating sites with habitats at risk that have not been cleaned-up or are not scheduled for remediation in the near future.

Activity 6. Determine usage of sites by wading birds. This activity should be undertaken only after activities 1-5 have been evaluated to determine if a need exists to continue with verification of usage. Determine foraging areas and habitat usage at sites. Examine concentrations of contaminants in prey items at sites.

Activity 7. Rank/prioritize sites for clean-up. Develop criteria to rank/prioritize listed sites of concern for clean-up. Once sites are ranked, make recommendations to site managers.

Implementation

Institutional Responsibilities

The primary lead agency will be the New Jersey and Chesapeake Bay field offices of the US Fish and Wildlife Service. Information would be taken from the EPA Region II and III and the individual state programs.

Schedule

The estimated time frame for completion of this strategy is about two years from the start date. For a summary of the schedule according to activity, see Table 17.

Location

This strategy will be focused on the 15 km heronry region, specifically at sites listed on the NPL and state RCRA programs. Clean-up recommendations will include adjacent impacted wetland areas.

Costs and Funding

Potential financing of this strategy could come from competitive funding from the USFWS and private foundations like the Fish and Wildlife foundation.

There will be little or no capital costs for implementation of this strategy, funding will be mostly needed for salary costs of a GS-9 or a GS-11. Associated costs may include travel money and printing for the questionnaires. Additional costs may be incurred if prey items are analyzed in Activity 6. See Table 17 for costs associated with each activity.

Performance Measures

Success of this strategy can be measured by the completion and dissemination of the site prioritization. Success can also be measured by lowered contaminant concentrations in prey items.

Review/Key Decisions

Look into the legal ramifications of sites that have been closed out but still pose risks to wading birds.

TABLE 17

Strategy C-6 -- Prioritize Sites for Clean-up According to Wading Bird Usage

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Obtain NPLs, state and RCRA hazardous waste sites within the 15 km radius.	USFWS	EPA, NJDEP, DNREC	1	✓								1	0		✓	USFWS, Fish and Wildlife Foundation
2. Identify sites with habitat risks and contaminants of concern.	USFWS	EPA, NJDEP, DNREC	10	✓	✓							10	0		✓	USFWS, Fish and Wildlife Foundation
3. Conduct literature search.	USFWS	EPA, NJDEP, DNREC	6		✓							6	0		✓	USFWS, Fish and Wildlife Foundation
4. Determine projected clean-up schedule.	USFWS	EPA, NJDEP, DNREC	1		✓							1	0		✓	USFWS, Fish and Wildlife Foundation
5. Finalize list.	USFWS	EPA, NJDEP, DNREC	2		✓							2	0		✓	USFWS, Fish and Wildlife Foundation
6. Determine usage of sites by wading birds.	USFWS	EPA, NJDEP, DNREC	6			✓	✓					6	0		✓	USFWS, Fish and Wildlife Foundation
7. Rank/prioritize sites for clean-up.	USFWS	EPA, NJDEP, DNREC	6				✓					6	0		✓	USFWS, Fish and Wildlife Foundation
Total Person Weeks = 32				Total Cost Quarters 1-8 = \$32,000												

Sensitive Areas Booming Strategies Locations in the 15 km Study Area

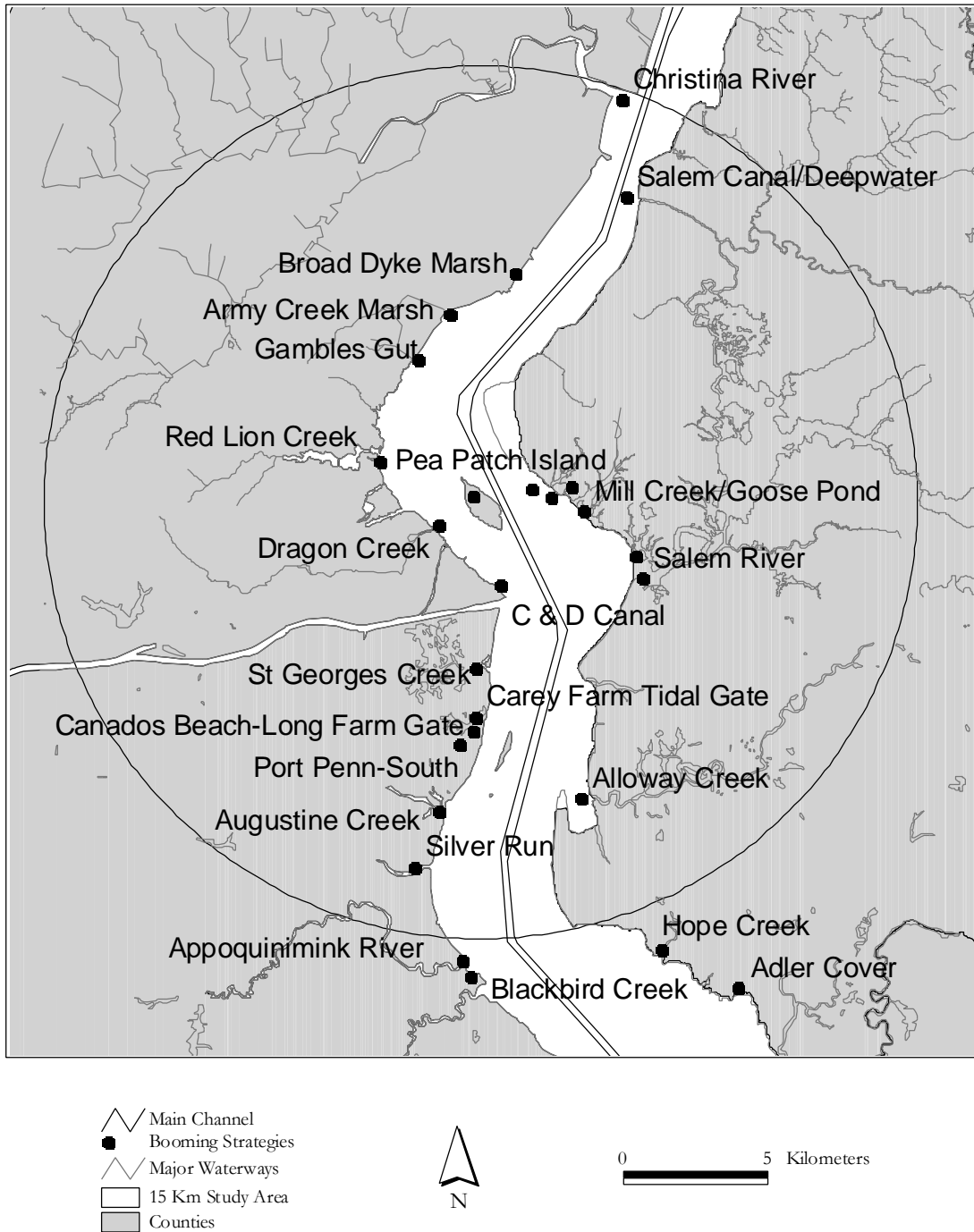


Figure 6. This map depicts the Sensitive Areas Annex in the Philadelphia Area Contingency Plan for oil spill response. The Sensitive Area Annex characterizes and prioritizes these sites in terms of their seasonal importance to wildlife, including herons and egrets. The Contingency Plan also includes a response section which details the recommended access, equipment, and procedures to be used for each of the sites that are identified. *Map created by the Delaware Coastal Management Program.*

OIL SPILLS/INDUSTRIAL ACCIDENTS

Description

The potential for an oil spill or industrial accident to cause harmful impacts to the heronry, as well as to many other forms of wildlife, is a major concern because of the close proximity of a major shipping channel and a large petrochemical industrial complex to the heronry. Over a ten-year period, the main shipping channel between Philadelphia and the Atlantic Ocean accommodated an average of 107 million tons per year involving over 150 different commodities. Crude petroleum and petroleum products represent more than 80% of the total tonnage of commodities moved. While oil spill prevention and response plans exist, there is still concern that more could be done to protect the unique resource that the heronry represents.

Discussion

Direct Impacts. Catastrophic spills of crude oil (and related products) can have both immediate consequences such as death due to oiling or starvation and longer-term sub-lethal impacts such as reduced reproductive success. These impacts have been documented in past oil spill events (Parsons 1996). Weather (especially winds and temperature), type of material spilled, time of year, tides and currents, and other conditions at the time of an oil spill greatly influence its ultimate fate and effects.

While much less frequent than oil spills, a single large accidental release of certain compounds (such as chlorine gas) could potentially decimate the bird population on the Island if environmental conditions at the time of the incident dispersed the material in that direction.

Indirect Impacts. Most of the indirect impacts relate to alterations in the natural system (e.g. modification in the food chain). These alterations may have short- and long-term impacts. For example, loss of certain habitat critical to a species at a lower level in the food chain could lead to shifts in target prey species for the wading birds. Such a shift may have repercussions throughout the ecosystem. While the effects of a major spill (1,000 or more barrels) are the focus of this characterization, it should be noted that the smaller spills that occur routinely in the study area also may have significant impacts on the heronry.

In addition to the impacts of the spilled material itself, there may be concerns about the effects of materials and methods used to respond to and clean up a spill. The use of dispersants for spill response may have unforeseen and unintended consequences and remains an issue of concern in some parts of the environmental community.

Shipborne Commodity Movement in the Region. All crude oil refined in the region is shipped up the channel from the mouth of the Delaware Bay. Crude oil accounts for over one-half (58%, or about 70 million tons) of the cargo shipped in the region in 1994 (US Army Corps of Engineers 1976-1995). Combined with petroleum products (25%) and chemicals and associated products (4%), fully 80 to 90% of the material moved on ships in the region might pose a hazard to the heronry and to the larger ecosystem. The US Coast Guard (1995) estimates that approximately 70% of all crude oil entering the Eastern United States transits the Delaware Bay.

Pipeline Commodity Movement in the Region. A significant amount of refined petroleum products are moved throughout the region by pipelines. Information on the locations and volumes of material moved through these pipelines may be included in future assessments as part of SAMP implementation.

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

Oil and Product Spill Patterns. Based on historic spill patterns of oil and related products, the areas surrounding and upstream of Pea Patch Island are most likely to experience a significant spill event. US Coast Guard spill data for the period 1974 to 1990 indicate there are more spills in the vicinity of the ports where transfer of materials takes place (NOAA 1996). This means a higher volume of material is spilled in the upper reaches of the estuary. Many of the spills occur during the transfer process itself. For other spills, such as groundings, local conditions (tides, currents, bottom topography and type) may play a role.

The largest recorded spill in the Delaware River was the result of the grounding of the T/V GRAND EAGLE in Marcus Hook in 1986. About 460,000 gallons of crude oil was released during the event. Another major spill also resulted from the grounding of a tank vessel in the Marcus Hook Range, the T/V PRESIDENTE RIVERA. This spill released about 300,000 gallons of number six fuel oil into the River in 1989.

These events, along with the patterns seen in maps of spills in the region (NOAA 1996), seem to confirm the statement that high risk areas are generally those places "where the greatest concentration of petroleum and chemical facilities are located" (USCG, 1995: Philadelphia Area Contingency Plan). The area upstream of Pea Patch Island represents such a concentration, and therefore should be considered "high risk". The Contingency Plan identifies nine areas that are considered to be at the highest risk of a major spill; of these, five are upstream of Pea Patch Island, one is in the immediate vicinity, and three are farther south in the Bay. Large spills near at least two of these areas (Marcus Hook and the C & D approaches) would be close enough to represent a direct threat to the heronry region.

Industrial Chemical Releases. No information linking releases of this type of material with any known adverse impacts on the wading bird colony on Pea Patch Island was identified during the preparation of this characterization. Releases of these materials in quantities sufficient to cause significant direct harm to the colony appear to be very infrequent. An analysis of historical data from US Coast Guard records for the Delaware River from Marcus Hook to Port Richmond indicate that 44 hazardous material spills of 50 gallons or more occurred between 1980 and 1990 (Research Planning Inc., 1991). Sulfuric acid was spilled most frequently followed by cumene, styrene, and sodium hydroxide.

Spill Prevention. Many spill prevention efforts come under the auspices of the U.S. Coast Guard and other institutions. Prevention can be considered within two broad categories: 1) prevention of accidents (personnel error, collisions, groundings, explosions, etc.) and 2) use of technology to contain/stop release of harmful substances to the environment when these accidents do occur (e.g. double hulls on tankers). Inspections, training programs, maintenance and installation of navigation aids, and development of new technology are all means of preventing oil spills.

Status of Spill Response Capability. There are several institutions that could have a significant role in the response to a major oil spill. Three of the more important are the Delaware Bay and River Cooperative (DBRC), the Marine Spill Response Corporation (MSRC), and the National Response Corporation (NRC). There are also many smaller contractors that may be called upon to respond to a spill in the region.

Potential Sources of Concern

Due to its location (proximity to the shipping channel and major petrochemical complexes) the heronry is especially vulnerable to a major mishap, even from well outside the study area. There are only a limited number of potential sources of a major spill in the region including ships, pipelines, tank cars, tank trucks, batch tanks. The following are some of the many factors that may determine when the next major spill occurs in the region.

The Human Factor. Many accidents and much of the material spilled result from human error. Several areas that might require attention have been identified: 1) training; 2) maintenance; 3) vessel and facility response

plans; 4) quality management practices; and 5) physical condition (fatigue, substance abuse, etc.) of crew and shoreside workers.

Institutional Resources to Respond to Spills/Accidents. More needs to be done to improve performance of responsible parties, in both the public and private sectors. In particular, it has been noted that 15 km zone around Pea Patch Island lacks the prestaging of equipment found in the northern Delaware River, where there are more facilities and historically more accidents. There has also been a reduction of joint regional response training.

Vessel/Facility Conditions. The ability to safely contain, transfer, and process materials is partially dependent on the condition of the equipment. There is a concern that some handlers/processors of crude oil (and perhaps chemicals) are concerned with only meeting the "minimum" criteria associated with any regulations or standards in their industry. Often the condition of equipment tends to be tied to the economic health of the company operating it. Over time, one would expect the more recently required technology for vessels under construction to replace existing spill prevention equipment/design.

Weather. While there is no compelling evidence that weather and sea state play a significant role in causing spills, they clearly can affect response. For example, at certain times of year there may be no response to a spill due to extremely adverse conditions (ice, etc.) (US Coast Guard 1995).

Real-Time Response Decision-making. The issue of how the perceptions of the public during a spill event can "steer" response decisions away from the recommendations of science and planning has been raised. Political figures are often pressured to "take action" by the public even if it is unwarranted or detrimental to the overall success of the response effort.

Shipping Regulations. The enforcement of marine safety laws and related regulations is a responsibility of the U.S. Coast Guard. The Coast Guard inspects foreign flagged ships and barges to ensure compliance with various marine safety standards and also responds to spills. They also inspect these ships to ensure that they meet Safety of Life at Sea (SOLAS) requirements and Maritime Pollution Prevention (MARPOL) regulations. Although foreign ships are issued certificates by the home government, the Coast Guard will also issue a certificate indicating that the ships inspected are in compliance with international standards as well U.S. regulations.

Recommended Targets and Strategies

Ten targets were developed by the Oil Spills/Industrial Accidents Group at the Issue Characterization Workshop in December 1996. These targets are described in the *Pea Patch Island Heronry Region Special Area Management Plan: Issue Characterizations*. Descriptions for 9 management strategies were developed during and immediately after the Strategy Development Workshop in April 1997. A subset of seven strategies were identified to be moved forward in the process for more refined thinking and description of implementation details. The targets and strategies being addressed in the SAMP are:

- OS-1** Produce Oil Spill Damage Estimates for Sensitive Areas.
- OS-2** Standardize Oil Transfer Regulations in Delaware River/Bay.
- OS-3** Pre-stage Appropriate Spill Response Resources Near Sensitive Areas.
- OS-4** Ensure That the Salem River Response Plan is Effective.
- OS-5** Establish Permanent Anchoring Points for Booming.

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

OS-6 Hold Spill Drills for all Sensitive Areas.

OS-7 Incorporate Hazing, Retrieval, and Transfer Plans in Wildlife Response Protocol.

Strategy OS-1 Produce Oil Spill Damage Assessment Estimates for Sensitive Areas

Activities:

- Select sensitive area(s) where estimates will be developed.
- Identify valuation technique(s).
- Identify/quantify resources at risk.
- Produce damage estimates based on spill scenarios.
- Provide estimates to potentially liable parties.

Participating Institutions:

- Delaware Department of Natural Resources and Environmental Control
- New Jersey Department of Environmental Protection
- National Oceanic and Atmospheric Administration
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Coast Guard
- Applied Science Associates, Inc.
- Delaware Bay and River Cooperative, Inc.

Schedule: Activities will begin as soon as funding becomes available. Draft estimates will be prepared within six months. Final estimates will be made available as soon as possible after comments on the draft are received.

Cost: \$22,000.

This strategy will develop natural resource value estimates for sensitive areas in the Heronry region. There are approximately 22 Sensitive Areas (as defined by the Area Contingency Plan) in the Pea Patch Island Heronry Region (see figure 6). For the most part, these areas represent the wetlands found on either side of the Delaware River North and South of Pea Patch Island. Each of these areas has an oil spill response plan in the form of a booming strategy along with other logistical information. The estimates developed by this strategy can be used to educate the public, industry, and decisionmakers on the value that these areas could potentially represent as part of an oil spill damage assessment (or similar) process. The numbers could be by season, by area or just a single figure. It is anticipated that increased awareness of the dollar value of these sensitive areas and the resources they contain will motivate responsible parties to focus spill prevention and response assets and capabilities on this critical region. Care will have to be taken to avoid biasing future legal actions with these figures by placing them in their proper context.

Primary Activities

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

Activity 1. Select sensitive area(s) where estimates will be developed. A team of knowledgeable individuals will determine which of the sensitive areas will be the best candidate(s) for this valuation process. Possible criteria for selection might include the size and ecological importance of the area (especially to the wading birds on Pea Patch Island), the status of the spill response capability, the relative risk of the area being oiled, and the ability to produce an estimate with a reasonable amount of effort. Anywhere from one to three sites may be chosen. No more than one or two half day meetings should be required to evaluate potential areas for inclusion. Nautical charts, Ecological Inventory maps, Environmental Sensitivity maps, as well as available spill models, would all be useful material to include in this evaluation.

The team should contain representatives from the U.S. Fish and Wildlife Service (USFWS), National Oceanic and Atmospheric Administration (NOAA), the Delaware Department of Natural Resources and Environmental Control (DNREC), the New Jersey Department of Environmental Protection (NJDEP), the U.S. Environmental Protection Agency (EPA), the U.S. Coast Guard (USCG), and response institutions (Delaware Bay and River Cooperative and the National Response Corporation). These players should be involved throughout all of the activities in this strategy, with other institutions playing more specific roles when necessary. A digital product that shows the location(s) of the area(s) should be produced for use in ArcView.

Activity 2. Identify valuation technique(s). There are several ways in which resource valuations could be developed. The team should consult with NOAA's Damage Assessment Center to determine the optimum method given the objectives of this strategy (very rough estimate for education purposes only). The team may also have to interact with Applied Science Associates, Inc., a firm that has contracted with NOAA to conduct damage assessment work in the past. ASA has produced a model that some institutions in the Delaware Bay region are using to examine potential impacts of oil spills. The team may find it is useful to have this software customized to meet the needs of this strategy.

Activity 3. Identify/quantify resources at risk. After identifying the way in which the estimates can be developed, an effort will have to be made to measure/quantify the resources that would be damaged. The type and amount of data needs will be a direct result of the valuation methods chosen. Again, since these estimates are only for educational purposes, the standards for accuracy and comprehensives are less than they would be for an "official," perhaps legally binding, set of figures. They should, nonetheless, represent a good faith estimate that will be perceived as being close enough to reality so as to be useful.

More than likely, some of this work will have to be done in a digital environment such as ArcView. It is anticipated that most of the data layers that may be necessary for this activity already exist or can be compiled very easily. If not, the amount of effort shown in Table 18 for this activity is too low. Both tabular and map summaries of this data should be produced.

Activity 4. Produce damage estimates based on scenarios. For purposes of this strategy, it will be assumed that most if not all of the selected sensitive area has been impacted by spilled oil. Therefore the location of the spill is not required to be used as input for a model that moves the oil through space. The volume and type of material however might make a difference in the impacts, even in the crude way proposed as part of this strategy. Therefore, it is suggested that at least two scenarios be developed for each spill in each area.

The actual process for generating the estimates of potential damages is unknown at this time. Depending on the valuation method chosen, this may be as simple as measuring the area of the wetland and multiplying it by a "standard" restoration cost per square meter. It is likely require some degree of expertise however the to include the direct (e.g. oiling) and indirect (e.g. loss of foraging habitat) impacts on the wading birds.

It is advisable that representatives from the oil transportation and processing industries be invited to participate in the process of implementing this strategy at least by the time this activity is under consideration.

By observing and shaping how the “numbers” are generated these important players will have a much better appreciation for their importance. Both tabular and map summaries of this data should be produced.

Activity 5. Provide estimates to potentially liable parties and other relevant private and public institutions (shippers, refiners, response organizations, etc.). After the numbers have been generated it is important they be disseminated to the institutions that have critical roles in the oil spill prevention and response capabilities in the region. At a minimum these include the shippers and processors of crude oil in the Heronry region and the contractors they have designated to handle their spill response needs.

The team will have to determine the most effective means to communicate the results of the valuations and the larger message of the need for adequate response capabilities for all of the sensitive areas in the Heronry region. Possible techniques include production of a briefing package that can be presented at regular meetings of target groups or a series of one on one sessions with key institutions. The team, with the assistance of the SAMP Core Group would have to determine if the valuations and the process used to determine them have a wider audience within the SAMP context. Could/should the numbers for example, find their way into other educational materials developed for the SAMP?

Implementation

Institutional Responsibilities

The implementation of this strategy will be lead by DNREC with close cooperation from the team members identified in Activity 1. NOAA's Office of Ocean Resources, Conservation and Assessment will also provide support and guidance. The institutions having lead responsibility for each activity, those providing support, and the level of effort that will be required to implement the activity are shown in Table 18.

Schedule

The schedule for implementing and completing these activities is shown in Table 18. No work has begun on this strategy.

Location

This strategy will focus on between one and three specific areas in the Pea Patch Island Heronry Region that meet the criteria outlined in Activity 1. These areas should be representative of other sites within the Heronry region. There will not be any “on the ground” activity associated with this strategy.

Costs and Funding

This strategy will require approximately \$10,000 to \$30,000 in labor to implement. No ongoing costs for operation and maintenance are anticipated, as this is a one-time implementation. Table 18 shows the costs as well as potential funding sources. Most of the expense is associated with compilation of natural resource data to be used in the valuation process. It is anticipated that all costs can be covered by in-kind services from the agencies involved.

Performance Measures

Success of the strategy will be determined by the ability to generate a meaningful value for each sensitive area selected in a cost-effective, simple manner. The acceptance of these values as “valid” by industry will be a further measure of success.

Review/Key Decisions

The inclusion of the handlers and processors of oil in this process is critical if the numbers are to be accepted as valid. They should be part of discussions from the beginning of implementation. A great deal of care

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

will be required to ensure that the numbers generated by this strategy are developed in a manner well-understood by everyone who will see them. If the figures can not be easily explained they will be meaningless. The team working on this strategy should make it clear to all that they are not attempting to produce a figure that will be used in any future legal action.

TABLE 18

Strategy OS-1 -- Produce Oil Spill Damage Estimates for Sensitive Areas

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Select sensitive area(s) where estimates will be developed.	DNREC	NJDEP, USCG, USFWS	1	✓								1	0		In-kind services	NJDEP, USCG, USFWS
2. Identify valuation technique(s).	DNREC	DNREC, NJDEP, NOAA-ORCA, USCG	3	✓								3	0		In-kind services	DNREC, NJDEP, NOAA-ORCA, USCG
3. Identify/quantify resources at risk.	DNREC	DNREC, NJDEP, USCG, USFWS	3		✓							3	0		In-kind services	DNREC, NJDEP, USCG, USFWS
4. Produce damage estimates based on scenarios.	DNREC	DNREC, NJDEP, USCG, USFWS	10		✓							10	0		In-kind services	DNREC, NJDEP, USCG, USFWS
5. Provide estimates to interested parties.	DNREC	DNREC, NJDEP, USCG, USFWS	5		✓	✓						5	0		In-kind services	DNREC, NJDEP, USCG, USFWS
Total Person Weeks =				22								Total Cost Quarters 1-8 =		\$22,000		

Strategy OS-2

Standardize Oil Transfer Regulations in Delaware River/Bay

Activities:

- Evaluate existing legislation to determine where revisions are required.
- Draft proposed legislation that encompasses all types of transfers.
- Submit proposals to each state assembly and market/justify. Gain support/sponsor.
- Provide draft regulations to each appropriate state regulating body.
- Ensure mechanism is in place to get law passed-regulations adopted.

Participating Institutions:

- **Delaware Estuary Program.**
- Delaware Department of Natural Resources and Environmental Control.
- Pennsylvania Department of Environmental Protection.
- New Jersey Department of Environmental Protection.
- U.S. Coast Guard.
- Philadelphia Port Area Committee.

Schedule: This strategy will be complete within a year of implementation.

Cost: \$20,000 to \$30,000.

This strategy will develop legislation for adoption by the appropriate legislative authorities in the three states adjacent to the Delaware Bay/River to require the booming of vessels involved in the bulk transfer of oil. It will be proposed that booming be required for all petroleum products with a flash point of over 100 degrees Fahrenheit, whether as cargo, fuel, or ship stores. The regulations that most closely resemble a desired outcome are those already in place in New Jersey, although modifications to those in place would still be sought.

Primary Activities

Activity 1. Evaluate existing legislation to determine where revisions are required. A team of knowledgeable individuals will have to determine how the existing booming regulations should be modified to enhance protection of the Delaware River and Bay from oil spills during transfer operations. Copies of the existing regulations will have to be made available to the team and a brief series of meetings will be arranged to discuss the benefits and costs of changes to these regulations. Regulations in place in other areas may be examined for ideas. If deemed necessary by the team, a survey of existing regulations in other port areas may be conducted.

The team should contain representatives from the Delaware Estuary Program, the Pea Patch Island SAMP Core Group, the Delaware Department of Natural Resources and Environmental Control, the New Jersey Department of Environmental Protection, the Pennsylvania Department of Environmental Protection, the US Coast Guard, and other members of the Philadelphia Port Area Committee. These players should be

involved throughout all of the activities in this strategy, with other institutions playing more specific roles when necessary.

Activity 2. Draft proposed legislation that encompasses all types of transfers. After reviewing the existing regulations, modifications will be discussed among the members of the team to determine what is desirable and feasible. The form of the draft should follow that used in the state. A very rough evaluation of the benefits and costs (economic and environmental) should be performed to help determine what regulations represent the optimum set for further consideration. Some statistics on volumes of oil that may be released under current practices should be developed to bolster the case for change.

Activity 3. Submit proposals to each state assembly and market/justify. Gain support/sponsor. Someone will have to determine the proper contacts within the state legislatures for listening to the proposal developed in Activity 2. It may be appropriate to involve other institutions interested in protecting the water quality of the river (e.g. NGOs, EPA) in a concerted effort to promote the need for these regulations.

Activity 4. Provide draft regulations to each appropriate state regulating body. Encourage upper levels of the three main state regulatory agencies to review and comment on the proposed regulations as they will ultimately have to put them into practice.

Activity 5. Ensure mechanism is in place to get law passed-regulations adopted. A means of tracking the progress of the legislation will have to be developed. A single point of contact will be necessary in each state to serve as a conduit for information to pass both ways as part of the process. Selected members of the team will have to be ready to provide input on short notice. Ideally the team will broaden the base of support for the legislation by briefing other interested institutions through the Delaware Bay region.

Implementation

Institutional Responsibilities

The implementation of this strategy will be lead by DELEP with close cooperation from the team members identified in Activity 1. The institutions having lead responsibility for each activity, those providing support, and the level of effort that will be required to implement the activity are shown in Table 19.

Schedule

The schedule for implementing and completing these activities is shown in Table 19. No work has begun on this strategy.

Location

This strategy will apply to vessel transfers that take place throughout each of the three states. If statewide application proves too difficult then the regulations should focus on activity within the Heronry Region.

Costs and Funding

This strategy will require approximately \$10,000 to \$30,000 in labor to implement. There may also be some limited travel expense to meet with contacts in state capitals. No ongoing costs for operation and maintenance are anticipated as this is a one-time implementation. Table 19 shows the costs associated with the first two years of implementation as well as potential funding sources. Most of the expense is associated with the time and effort involved in identifying, contacting, and working with the appropriate legislative and executive contacts.

It is anticipated that all costs can be covered by in-kind services from the agencies involved.

Performance Measures

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

Success of the strategy will be determined by the passage of legislation similar to that proposed by the SAMP team. Documentation of future transfer spills contained by booming will be another measure of success.

Review/Key Decisions

As with strategy OS-1, the inclusion of the handlers and processors of oil is important. The team should seek out information from industry on how booming has helped prevent greater damage during transfer operations in New Jersey, where laws are already on the books. Making industry aware of the proposed regulations and asking them to be part of discussions from the beginning of implementation should promote a more cooperative approach to meeting the objectives of this strategy.

TABLE 19

Strategy OS-2 -- Standardize Oil Transfer Regulations in Delaware River/Bay

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Evaluate existing legislation.	DELEP	NJDEP, PADEP, DNREC, USCG, PPAC	2	✓								2	0		In-kind services	NJDEP, PADEP, DNREC, USCG, PPAC
2. Draft proposed legislation.	DELEP	NJDEP, PADEP, DNREC, USCG, PPAC	4	✓	✓							4	0		In-kind services	NJDEP, PADEP, DNREC, USCG, PPAC
3. Submit proposals to each state assembly.	DELEP	NJDEP, PADEP, DNREC, USCG, PPAC	3		✓							3	0		In-kind services	NJDEP, PADEP, DNREC, USCG, PPAC
4. Provide draft regulations to state regulatory bodies.	DELEP	NJDEP, PADEP, DNREC, USCG, PPAC	2		✓	✓						2	0		In-kind services	NJDEP, PADEP, DNREC, USCG, PPAC
5. Develop mechanism to get law passed and regulations adopted.	DELEP	NJDEP, PADEP, DNREC, USCG, PPAC	10			✓	✓					10	0		In-kind services	NJDEP, PADEP, DNREC, USCG, PPAC
Total Person Weeks = 21				Total Cost Quarters 1-8 = \$21,000												

Strategy OS-3 Prestage Appropriate Spill Response Resources Near Sensitive Areas

Activities:

- Evaluate response plans after drills to determine need for additional prestaging.
- Develop materials and storage cost estimates for additional prestaging, where necessary.
- Submit proposals to appropriate institutions(s).
- Follow up to see that response resources are in place.

Participating Institutions:

- U.S. Coast Guard
- Delaware Department of Natural Resources and Environmental Control
- New Jersey Department of Environmental Protection
- Philadelphia Port Area Committee
- Delaware Bay and River Cooperative
- National Response Corporation
- Marine Spill Response Corporation

Schedule: This strategy can be complete within one and a half years of implementation. It will take approximately one year to evaluate spill drills and develop cost estimates. Activities 3-4 could take an additional six months.

Cost: \$31,000.

This strategy is an outgrowth of Strategy OS-6 (Hold Spill Drills for all Sensitive Areas). It is designed to ensure that any needed spill response resources identified as part of the spill drills are available when and where they would be necessary during a real spill. This may mean that additional response resources should be placed in the heronry region. A key difficulty in implementing this strategy will be getting institutions who might be potentially liable for future oil spills to spend more money today on response resources that may never be needed. This strategy will focus on identifying the most cost-effective way to provide the protection necessary.

Primary Activities

Activity 1. Evaluate spill drills to determine need for additional prestaging. A team of knowledgeable individuals will determine whether the response equipment required to implement each drill is placed in the most efficient location. This determination should be based on length of time required to put resources into action, access to transshipment points, cost, and other factors identified by the team. At least one member of the team should be present at each drill. Evaluation debriefings should be conducted by the team to learn from the response personnel themselves how the availability of equipment played a role in the drill.

The team should contain representatives from the U.S. Coast Guard, Delaware Department of Natural Resources and Environmental Control, the New Jersey Department of Environmental Protection, and response institutions (Delaware Bay and River Cooperative, the National Response Corporation, and the Marine Spill Response Corporation). These players should be involved throughout all of the activities in this strategy, with other institutions playing more specific roles when necessary.

A digital product that shows the location(s) of the response resource(s) in the region should be produced for use in ArcView.

Activity 2. Develop materials and storage cost estimates for additional prestaging, where necessary. Based on the results of Activity 1, there may be a need to redistribute and/or augment response resources in the region. An important step to making this happen is developing realistic cost estimates for the new distribution. These estimates need to include at a minimum the cost of 1) additional equipment, 2) leasing of storage space, and 3) reductions/increases in transportation costs (moving equipment from storage to response site). If they cooperate, the response institutions on the team will be the best source of the financial requirements. The team will have to decide whether it would be better to wait until most or even all of the drills are conducted before they try to understand how best to have the response resources realigned.

Activity 3. Submit proposals to funding institutions. After identifying the approximate costs of realigning response resources in the region, the team will have to convince the appropriate funding institutions that the realignment is a good investment. This will be determined in part by the results of strategy OS-1 (Oil Spill Damage Estimates). If the resources at risk are valuable enough, one would hope that the potentially liable parties would be interested in minimizing their risk exposure by modifying their response plans accordingly.

This activity is complicated by the fact that the response institutions (DBRC, NRC, and MSRC) are not the potentially liable institutions. They are separate legal entities hired to supply their services (including plans, equipment, people) to others in the case of a spill. The budgets, and consequently the ability to implement the recommendations that come out of this strategy, of at least two of the firms (DBRC and MSRC) are controlled in large part by some of the potentially liable parties. It is unclear if the response institutions will be interested in requesting increases or modifications in their budgets to implement any proposed realignments.

Activity 4. Follow up to see that response resources are in place. The team should investigate the status of response resources within a reasonable amount of time after the proposals have been accepted by the funding institutions and the schedules for implementing the realignments say they should be in place. This may require visiting sites with representatives from the response institutions.

Implementation

Institutional Responsibilities

The implementation of this strategy will be lead by the U.S. Coast Guard with close cooperation from the other team members identified in Activity 1. Table 20 lists the institutions having lead responsibility for each activity, those providing support, and the level of effort that will be required to implement the activity.

Schedule

The schedule for implementing and completing these activities is shown in Table 20. No work has begun on this strategy, but it is not anticipated that it could be completed for the entire region before 2000.

Location

This strategy will address the response plan requirements for at least 22 sensitive areas within the heronry region. There are "on the ground" activities associated with this strategy including presence at spill drills and visits to prestaging areas.

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

Costs and Funding

This strategy will require approximately \$25,000 to \$35,000 in labor costs to implement. Ongoing costs for operation and maintenance are minimal (\$1K) and would be associated with periodic checks on the distribution of response resources. Table 20 shows the costs through the first two years of implementation, as well as potential funding sources. Most of the expense is associated with the time of the team assembled to evaluate drills and propose alternative response resource distributions. Costs of actually placing the response resources would be the responsibility of the potentially liable parties. These costs will not be known until activity two is completed.

It is anticipated that all costs can be covered by in-kind services from the institutions involved.

Performance Measures

Success of the strategy will be determined by the degree to which required response resources are placed in recommended locations within a reasonable time frame.

Review/Key Decisions

The success of this strategy hinges on the ability of the team to convince the funding institutions, primarily oil companies and shipping companies, that their response preparedness expenditures may need to increase. There will likely be resistance to paying for something that in the words of one key player “may never be used.” The competitive nature of the response industry as represented by the three firms in the region MSRC, DBRC, and NRC also complicates how this strategy gets implemented. There are no incentives for these institutions to cooperate and evidence indicates that “bottom line” concerns are driving response standards downward. Like some of the other oil spill strategies, success will depend on the types of values strategy OS-1 (oil spill damage assessment estimates) generates.

Strategy OS-3 -- Prestage Appropriate Spill Response Resources Near Sensitive Areas

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter 3 year increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Evaluate spill drills.	USCG	DBRC, NRC, MSRC, DNREC, NJDEP	22	✓	✓	✓	✓					22	0		In-kind services	DBRC, NRC, MSRC, DNREC, NJDEP
2. Develop cost estimates.	USCG	DBRC, NRC, MSRC, DNREC, NJDEP	4		✓	✓	✓					4	0		In-kind services	DBRC, NRC, MSRC, DNREC, NJDEP
3. Submit proposals.	USCG	DBRC, NRC, MSRC, DNREC, NJDEP	3				✓	✓				3	0		In-kind services	DBRC, NRC, MSRC, DNREC, NJDEP
4. Follow-up.	USCG	DBRC, NRC, MSRC, DNREC, NJDEP	2					✓				2	1/year		In-kind services	DBRC, NRC, MSRC, DNREC, NJDEP
Total Person Weeks = 31				Total Cost Quarters 1-8 = \$31,000												

Strategy OS-4 Ensure That Salem River Response Plan is Effective

Activities:

- Hold spill drill for Salem River.
- Evaluate drill and identify areas of concern.
- Identify similar situations in the response community.
- Investigate means of addressing concerns.
- Modify response plan as necessary.

Participating Institutions:

- U.S. Coast Guard
- Delaware Bay and River Cooperative
- New Jersey Department of Environmental Protection

Schedule: Completion of all activities will occur within nine months of implementation.

Cost: \$17,000

This strategy will develop a response plan for the protection of the sensitive areas in and upstream of the Salem River in New Jersey. There are questions to whether the existing response plan is adequate due to difficulty in booming the fast moving tidal currents at the mouth of the river. This strategy is a more specific implementation of OS-6 and OS-3 for this particular area. This focus is warranted because the wetlands in this area have been identified as one of the most critical habitats to the long-term survival of the heronry.

Primary Activities

Activity 1. Hold spill drill for Salem River. The Salem River should be one of the first sites selected for a spill drill as part of strategy OS-6. This drill will be held by DBRC as part of their regular testing of response plans in the region. SAMP representatives from the US Coast Guard (USCG) and New Jersey Department of Environmental Protection (NJDEP) were present to observe the effectiveness of the plan.

Activity 2. Evaluate drill and identify areas of concern. The DBRC, in conjunction with USCG and NJDEP will determine what areas of the response plan are in need of revision.

Activity 3. Identify similar situations in the response community. After identifying the parts of the plan that are of concern, the NJDEP will investigate where similar circumstances are concerns in other locations. Potential sites may be found in anywhere in the country (or the world). Candidate sites will likely have similar tidal cycles and currents and physical dimensions (depth, width).

Activity 4. Investigate means of addressing concerns. After identifying possible sites where similar circumstances may exist, DBRC and NJDEP will contact the appropriate response authorities to determine how the plans are designed to address the conditions causing difficulties in the Salem River. Use of contacts in the response industry is probably the quickest way to learn what possible solutions may be applicable. After

putting all of the potential solutions on the table, DBRC in consultation with the USCG and NJDEP will select a best option for implementation.

Activity 5. Modify response plan as necessary. The official response plan for the river will be modified to reflect the changes necessary to ensure protection of the sensitive areas during an oil spill. This plan will be “owned” by DBRC and may not be immediately available to other response institutions without some form of compensation to DBRC. Testing of the revised plan should occur within two years of its adoption.

Implementation

Institutional Responsibilities

The implementation of this strategy will be lead by USCG with close cooperation from DBRC and NJDEP. DBRC is the lead local institution for responding to oil spills in the heronry region and appears to be the most likely firm to have the local knowledge to implement the best practical plan. Table 21 lists the institutions having lead responsibility for each activity, those providing support, and the level of effort that will be required to implement the activity.

Schedule

The schedule for implementing and completing these activities is shown in Table 21. Once work begins on this strategy it is estimated that all activities can be complete within nine months.

Location

This strategy will focus on the Salem River and its approaches specifically. Conducting the drill will be an “on the ground” activity associated with this strategy.

Costs and Funding

This strategy will require approximately \$15,000 to \$20,000 in labor to implement. No ongoing costs for operation and maintenance are anticipated, as this is a one-time implementation. Table 21 shows the cost for each activity, as well as potential funding sources. Most of the expense is associated with compilation of natural resource data to be used in the valuation process.

It is anticipated that all costs can be covered by in-kind services from the agencies involved.

Cost for implementing any necessary revisions, including additional equipment, prestaging, etc., will be borne by the appropriate response institution(s). These costs will not be known until a revised plan is prepared.

Performance Measures

Success of the strategy will be determined by the ability to identify and correct deficiencies (if any) in the existing response plan for the Salem River. A successful drill within two years of the adoption of the revised plan will satisfy existing concerns.

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

Review/Key Decisions

The greatest potential difficulty with this strategy is the ability to have a revised response plan for this area available to parties other than DBRC. Due to the competitive nature of supplying response services in this region, DBRC will view any plan they develop as proprietary information and guard it closely. A mechanism to have others pay for or otherwise compensate DBRC for this information may have to be developed.

TABLE 21

Strategy OS-4 -- Ensure that Salem River Response Plan is Effective

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Hold spill drill for Salem River.	DBRC	NRC, DNREC, NJDEP	10	✓								10	0	In-kind services		DBRC, USCG, NJDEP
2. Evaluate and identify areas of concern.	DBRC	NRC,DNREC, NJDEP	2	✓								2	0	In-kind services		DBRC, USCG, NJDEP
3. Identify similar situations in the response community.	NJDEP	DBRC, NRC, DNREC	1		✓							1	0		In-kind services	DBRC, USCG, NJDEP
4. Investigate means of addressing concerns.	DBRC	NRC, DNREC, NJDEP	2		✓	✓						2	0		In-kind services	DBRC, USCG, NJDEP
5. Modify response plan as necessary.	DBRC	NRC, DNREC, NJDEP	2			✓						2	0		In-kind services	DBRC, USCG, NJDEP
Total Person Weeks = 17				Total Cost Quarters 1-8 = \$17,000												

Strategy OS-5 Establish Permanent Anchor Points for Booming

Activities:

- Assess need for permanent points in the heronry region and establish priority sites.
- Field test locations for effectiveness.
- Report results of tests and forward for approval.
- Install anchor points.

Participating Institutions:

- Philadelphia Port Area Committee
- Delaware Department of Natural Resources and Environmental Control
- New Jersey Department of Environmental Protection
- U.S. Coast Guard
- U.S. EPA
- U.S. Army Corps of Engineers
- Delaware Bay and River Cooperative
- National Response Corporation

Schedule: Activities will begin as soon as funding can be obtained. All sites will be installed within two years of the last spill drill.

Cost: \$27,000 for a single anchor point. Each additional point will require an additional \$10,000 - \$20,000 to install.

This strategy will determine the optimum points for mooring and anchoring booms to be used during spill response. Site selection will be based on geomorphological and ecological concerns as well as the practicality of placing booms at the site. There are currently only a limited number of permanent booming points in the heronry region. Site selection and permitting have taken a significant amount of effort in the past. Both vessels and facility spills should be considered when identifying potential booming points. Few sites may actually be required after all factors are taken into consideration. This strategy will be conducted after the estimates for Strategy OS-1 (Spill Damage Assessment Estimates for Sensitive Areas) are available. This strategy would be implemented in conjunction with Strategy OS-6 (Hold Spill Drills for all Sensitive Areas).

Primary Activities

Activity 1. Assess need for permanent points in the heronry region. A team of knowledgeable individuals will determine which sites in the heronry region are the most suitable and important for permanent anchoring points for booms. An examination of existing plans should reveal where booms are designed to be placed. Existing permanent points and the methods used to establish them should be compiled. Considerations for identifying potential sites should include seasonal and tidal characteristics, boom types, impacts on area caused by booms, impacts on navigation, and practicality.

The team should contain representatives from the Delaware Department of Natural Resources and Environmental Control, the New Jersey Department of Environmental Protection, the U.S. Coast Guard, The U.S. Army Corps of Engineers, and response institutions (Delaware Bay and River Cooperative and the National Response Corporation).

A digital product that shows the locations of the potential anchor sites should be produced for use in ArcView. Other GIS data layers available from local and regional sources may help determine suitable locations.

Activity 2. Field test locations for effectiveness. After the team has prioritized the sites, they should be investigated as part of the drills held for each of the sensitive areas (Strategy OS-6). These drills will help determine the optimum locations for anchoring for spill response. The team will also have to ensure that these locations are suitable based on the criteria identified in Activity 1.

Activity 3. Report results of tests and forward for approval. After the sites have been tested, a list of priorities will be forwarded to PPAC. The committee will review the list and request the appropriate institutions to install the anchor points. The committee should be well aware of the list beforehand as some of its members are participants in the site selection process from the beginning.

Activity 4. Install anchor points. Upon receipt of the list, institutions will be asked to implement a construction program to install the anchoring points. These institutions are not known at this time. They may be state or Federal. SAMP members will be asked to help expedite permitting through their institutions.

Implementation

Institutional Responsibilities

The implementation of this strategy will be lead by the Philadelphia Port Area Committee, with close cooperation from the team members identified in Activity 1. Table 22 lists the institutions having lead responsibility for each activity, those providing support, and the level of effort that will be required to implement the activity.

Schedule

The schedule for implementing and completing these activities is shown in Table 22. No work has begun on this strategy, but it is anticipated that it could be well underway in 1999 and completed in 2000.

Location

This strategy will focus on a limited number of sites within the heronry region that meet the criteria outlined in Activity 1. Site visits during drills and installation of anchor points are “on the ground” activities associated with this strategy.

Costs and Funding

This strategy will require approximately \$5,000 to \$15,000 in labor to implement during the planning phases. Ongoing costs for operation and maintenance are expected to range between \$10,000 and \$50,000 depending on the number of points that are placed. Most of the expense will be associated with the installation of the anchor points. See Table 22 for costs and staffing resources associated with each activity.

Performance Measures

Success of the strategy will be determined by the percentage of recommended permanent sites that are installed within two years. However, the effectiveness of these sites during an actual spill will be the ultimate measure of success.

Review/Key Decisions

It will be critical that only a limited number of sites are identified in this first needs assessment. The point of the strategy is to find some key locations where permanent structures would have a significant positive impact on the response capability. The analysis of where these sites are must stay simple and focused. Also, a number of administrative hurdles will have to be cleared before construction can begin. Most dealing with the required permits to place these structures in water. Having the US Army Corps of Engineers participate throughout the process should help facilitate permitting.

TABLE 22

Strategy OS-5 -- Establish Permanent Anchor Points for Booming

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Assess need for permanent points and establish priority issues.	PPAC	USCG, NJDEP, DNREC, EPA, USACE, DBRC, NRC	4	✓								4	0		In-kind services	USCG, NJDEP, DNREC, EPA, USACE, DBRC, NCR
2. Field test locations for effectiveness.	PPAC	USCG, NJDEP, DNREC, EPA, USACE, DBRC, NRC	3		✓	✓	✓					6	0		In-kind services	USCG, NJDEP, DNREC, EPA, USACE, DBRC, NCR
3. Repoert results of tests and foward for approval.	PPAC	USCG, NJDEP, DNREC, EPA, USACE, DBRC, NRC	4				✓					4	0		In-kind services	USCG, NJDEP, DNREC, EPA, USACE, DBRC, NCR
4. Install and maintain anchor points.	PPAC	USCG, NJDEP, DNREC, EPA, USACE, DBRC, NRC	4					✓	✓			13	25		Unknown	Unknown
Total Person Weeks = 15				Total Cost Quarters 1-8 = \$27,000*												

* includes cost of a single anchor point. Each additional anchor point will cost \$10,000 - \$20,000 to install.

Strategy OS-6 Hold Spill Drills for all Sensitive Areas

Activities:

- Identify all sensitive areas within 15 km of Pea Patch Island.
- Obtain existing schedule for drills and prioritize.
- Identify response resources necessary to implement drills.
- Request that responsible institutions conduct drills.
- Evaluate/modify response plans.

Participating Institutions:

- **U.S. Coast Guard**
- U.S. Fish and Wildlife Service
- U.S. Environmental Protection Agency
- Delaware Department of Natural Resources and Environmental Control
- New Jersey Department of Environmental Protection
- Philadelphia Port Area Committee
- Delaware Bay and River Cooperative
- National Response Corporation

Schedule: Strategy can begin as soon as funding is obtained. Activities 1-3 can be completed within three months of start date. Activities 4-5 will be complete within two years.

Cost: \$308,000.

This strategy will seek to test the effectiveness of oil spill response resources dedicated to the protection of the sensitive areas surrounding Pea Patch Island. These resources come from a number of responsible institutions and are currently being tested on an infrequent schedule (perhaps two to three sites per year). Due to the dependence of the wading birds of Pea Patch Island on the sensitive areas along either side of the Delaware River, the SAMP seeks to ensure that these special areas are safe from preventable harm.

Primary Activities

Activity 1. Identify all sensitive areas within 15 km of Pea Patch Island. This activity has already been initiated as part of the SAMP issue characterization work. A draft map of the sensitive areas that have booming strategies is shown in figure 6. This map will be reviewed for accuracy.

Activity 2. Obtain existing schedule for drills and prioritize. The U.S. Coast Guard will need to contact the response institutions in the region to determine what drills are planned for the upcoming two-year period. Sensitive areas not on the list will have to be put in priority order for placement on a proposed, revised schedule. This prioritization should be based on criteria decided upon by a team that includes USFWS, DNREC, NJDEP, and USEPA. These criteria should attempt to capture the importance of the areas to the wading birds.

Activity 3. Identify response resources necessary to implement drills. After identifying the proposed drill schedule, it will be necessary to develop a budget for the resources required to implement it. This must be done by or in concert with the assistance of, the response institutions in the region (DBRC and NRC). They should already have tentative budgets for drill costs. These budgets will also have to recognize the number of people who will have to be pulled from other duties to participate in the drills.

Activity 4. Request that responsible institutions conduct drills. After budgets have been drawn up, the team will have to convince the funding institutions of the response organizations to support this accelerated schedule of drills in the heronry region. The forum for advancing this agenda has not been identified. It could take place as part of a regular meeting of the member companies or may require a special session. Information developed as part of strategy OS-1 will be critical to convincing the member companies of the need to have adequate response plans in place. The team should defer to the advice of the response organizations on the best method for garnering support from member companies.

Once supported, drills will proceed on a regular basis over a two-year period. It is anticipated that about one drill per month would be required to test all of the booming strategies in the heronry region. At least one member of the team from USCG, NJDEP, DNREC, USEPA, or USFWS should be present at each.

Activity 5. Evaluate/modify response plans. As each drill is conducted, it will be necessary to evaluate the adequacy of the plan and propose revisions where appropriate. This evaluation should be conducted by the response institution with the support of the member(s) of the Team who attended the drill.

As with the modified plan for the Salem River that may be developed as part of Strategy OS-4, these plans would also be viewed as the “property” of the response institutions that developed them. This is a problem that extends beyond the range of this strategy but needs to be adduced if effective response plans are to be available for all potential users.

Implementation

Institutional Responsibilities

The implementation of this strategy will be lead by USCG with close cooperation from the team members identified in Activity 2. Table 23 lists the institutions having lead responsibility for each activity, those providing support, and the level of effort that will be required to implement the activity.

Schedule

The schedule for implementing and completing these activities is shown in Table 23. Work has begun on Activity 1. It is anticipated that it could be completed within two years.

Location

This strategy will deal with the 20 or so Sensitive Areas in the heronry region. These areas are largely wetlands that border the Delaware River on either side upstream and downstream of Pea Patch Island. Most of the activity for this strategy will be “on the ground,” devoted to testing the effectiveness of existing spill response plans.

Costs and Funding

This strategy will require approximately \$275,000 to \$325,000 to implement, mostly in labor. No ongoing costs for operation and maintenance are anticipated, as this is a one-time implementation. Table 23 shows the costs and funding sources associated with each activity. Most of the expense is associated with conducting the spill response drills. It is anticipated that all costs associated with planning and evaluating the

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

drills can be covered by in-kind services from the agencies involved. Costs related to the increased frequency of the drills will have to be funded by either the companies that support the response institutions or by unknown sources.

Performance Measures

The completion of one drill for each site within two years and the revision of response plans as necessary will determine success of the strategy.

Review/Key Decisions

The ability to garner the additional funding from member companies to support an accelerated schedule of drills is the biggest hurdle in this strategy. Also of concern however, is the possible reluctance of response institutions to share revised plans with other institutions. The second issue is a symptom of a wider concern regarding the competitive nature of spill response services in the region and the ability of these response forms to “deliver the goods” during a real event.

Strategy OS-6 -- Hold Spill Drills for All Sensitive Areas

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Identify all sensitive areas within 15 km of PPI.	USFWS	NJDEP, DNREC, PPAC	1	✓								1	0		In-kind services	USFWS, NJDEP, DNREC, PPAC
2. Obtain existing schedule for drills and prioritize.	USCG	PPAC	1	✓								1	0		In-kind services	USCG
3. Identify response resources necessary to implement drills.	USCG	PPAC, DBRC, NCR	3	✓								6	0		In-kind services	USCG, PPAC, DBRC, NRC
4. Request that responsible institutions conduct drills.	USCG	DNREC, NJDEP, USFWS, PPAC, NCR, DBRC	22	✓	✓	✓	✓	✓	✓	✓	✓	240	0		In-kind services	USCG, DNREC, NJDEP, USFWS, PPAC, NCR, DBRC
5. Evaluate/modify response plans.	USCG	NCR, DBRC, DNREC, NJDEP, USFWS, PPAC	22	✓	✓	✓	✓	✓	✓	✓	✓	60	0		In-kind services	DNREC, NJDEP, USCG, USFWS
Total Person Weeks = 49				Total Cost Quarters 1-8 = \$308,000												

Strategy OS-7 Incorporate Hazing, Retrieval, and Transfer Plan in Wildlife Response Protocol

Activities:

- Determine seasonal pattern of Pea Patch Island use by wading birds.
- Evaluate possible hazing techniques.
- Develop hazing plan and implement.
- Develop retrieval plan and implement.
- Establish and train wildlife retrieval teams for Pea Patch Island.
- Develop transfer plan and implement.
- Drill all three plans.

Participating Institutions:

- U.S. Fish & Wildlife Service
- Tri-State Bird Research and Rescue
- Audubon Society
- Delaware Department of Natural Resources and Environmental Control
- Manomet Center for Conservation Sciences
- New Jersey Department of Environmental Protection
- Philadelphia Port Area Committee

Schedule: Activities are already underway. However, the protocol is currently not specific to wading birds.

Cost: \$82,000.

This strategy will develop three plans to be included in the existing Wildlife Response Protocol for the Oil Spill Contingency Plan for the Port of Philadelphia Area. The first is a plan to haze wading birds from areas that may be threatened during a spill event. At present, no organized means of creating a mass movement of the birds from the Pea Patch Island or other areas of concentration has been developed. While creating such a disturbance may be harmful, especially on Pea Patch Island during breeding season, it may be necessary in certain circumstances. The second plan is designed to provide for the efficient retrieval of live and dead wildlife by qualified individuals during a spill event. It is recognized that in some cases the ability of volunteers and others to handle this task has been found lacking. Properly trained and prepared people can make the survival rate of injured wildlife increase and also lead to better documentation of spill impacts on wildlife. The third plan complements the second by designing a means of transferring live animals and remains of dead ones to the appropriate rehabilitation or storage facilities. These plans are currently being drafted by the USFWS.

Primary Activities

Activity 1. Determine seasonal pattern of Island use by wading birds (species numbers by month). This information is already being collected by the DNREC in cooperation with the Manomet Center for Conservation Sciences (as part of strategy C-5). Results from the most recent two to three years of data collection may need to be reformatted for this purpose. This data should provide the information necessary to develop realistic scenarios for potential hazing requirements.

Activity 2. Evaluate possible hazing techniques. A brief survey of available hazing techniques should be conducted to determine the alternatives that will be most appropriate for use in this region. This survey may be conducted as a literature search and/or discussions with professionals who have experience in this field. The subset of the most appropriate techniques should be presented to a team made up of DNREC, NJDEP, and USFWS for consideration. They will have to jointly determine which technique(s) to recommend for inclusion in the hazing plan.

Activity 3. Develop hazing plan and implement. The recommendations of the Team identified in Activity 2 should be incorporated into a broader plan to move wildlife during emergencies in the region. This plan should be focused on preventing harm to the wading birds on Pea Patch Island by either moving them from the Island or from their foraging areas, depending on where the risk is greatest. The plan may include the pre-deployment of equipment. The plan will have to be approved by the Philadelphia Port Area Committee before it can be officially brought into the wider contingency plan for the region.

Activity 4. Develop retrieval plan and implement. The retrieval plan will need to address the issues surrounding the collection of animals (both dead and alive) that have been impacted by a spill. This plan must recognize the need for training, safety equipment, and appropriate permits for volunteers and others who are critical to the implementation of the plan during an emergency. It may also identify retrieval teams to be activated. Tri-State Bird Rescue and Audubon Society could be very helpful in assisting in the development of this plan.

Activity 5. Establish and train wildlife retrieval teams for Pea Patch Island. The team(s) identified in the retrieval plan will have to be trained as soon as possible. A third party or one of the three agencies listed in Activity 2 may conduct this training. This training should include in the field experience to make it as realistic as possible. OSHA training is also required. Certification of training is required in future emergencies.

Activity 6. Develop transfer plan and implement. This plan will complement the retrieval plan by moving the animals (dead and alive) to the next stage of processing. It should identify staging areas for medical stabilization of live animals (prior to transport) and processing of carcasses. It will also have to identify transport mechanisms to move live animals to rehabilitation facilities and the intake process for carcasses.

Activity 7. Drill all three plans. These plans should be tested as soon as possible to determine their effectiveness. These drills may be combined into a single large-scale exercise or conducted individually. As many of the expected participants in a real emergency should take part in the drill(s) as possible. Coordination with one or more of the spill drills anticipated in Strategy OS-6 will be ideal. After each drill, a debriefing should be held to decide where the plan could be improved.

Implementation

Institutional Responsibilities

The implementation of this strategy will be lead by USFWS with close cooperation from the team members identified in Activities 2 and 4. Table 24 lists the institutions having lead responsibility for each activity, those providing support, and the level of effort that will be required to implement the activity.

Schedule

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

The schedule for implementing and completing these activities is shown in Table 24. It is expected that all activities can be complete within two years, with additional time required for re-development and changes in plans as needed.

Location

The plans developed in this strategy will deal with wildlife response issues through the Philadelphia Port Region. Specific components of these plans will focus on the heronry. Some of the activity will take place on the ground when hazing equipment (if required) is placed in the field and drills are conducted.

Costs and Funding

This strategy will require approximately \$70,000 to \$90,000 (mostly in labor) to implement. There will be ongoing costs for operation and maintenance as training will have to be revisited on a regular basis and equipment will have to be maintained. Table 24 shows the costs associated with each activity as well as potential funding sources. The expense is divided evenly between plan development and the training and the purchase of equipment.

Funding for most of the implementation of the plans does not have a known source.

Performance Measures

Success of the strategy will be determined by the timely development and testing of the three plans. The dedication of sufficient resources to implement these plans will also be viewed as a measure of success.

Review/Key Decisions

The adoption of the plans by the Philadelphia Area Committee is the key decision in terms of review for content. The second and equally important decision will be the purchase of the necessary services and equipment to implement these plans. It is not clear which institution(s) have primary responsibility for protecting the wading birds and hence ensuring implementation of the plans.

TABLE 24

Strategy OS-7 -- Incorporate Hazing, Retrieval and Transfer Plan into Wildlife Response Protocol

Primary Activity	Proposed Lead	Primary Support	Person Weeks	Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
				1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Determine seasonal pattern of island use by wading birds.	DNREC	Manomet	1			✓						1	0	In-kind services		DNREC
2. Evaluate possible hazing techniques.	USFWS	DNREC, NJDEP	1			✓						1	0		In-kind services	USFWS, DNREC, NJDEP
3. Develop and implement hazing plan.	USFWS	DNREC, NJDEP	10	✓	✓	✓	✓	✓	✓			20	1	In-kind services	In-kind services	USFWS, DNREC, NJDEP
4. Develop and implement retrieval plan.	USFWS	DNREC, NJDEP, Audubon Society, Tri-State	10	✓	✓	✓	✓	✓	✓			20	1	In-kind services	In-kind services	USFWS, DNREC, NJDEP, Audubon, Tri-State
5. Establish and train wildlife retrieval teams for PPI.	USFWS	DNREC, NJDEP, Audubon Society, Tri-State	10				✓	✓	✓			10	5		Unknown	USFWS, DNREC, NJDEP, Audubon, Tri-State
6. Develop and implement transfer plan.	USFWS	DNREC, NJDEP, Audubon Society, Tri-State	10	✓	✓	✓	✓	✓	✓			20	1	In-kind services	In-kind services	USFWS, DNREC, NJDEP, Audubon, Tri-State
7. Drill all three plans.	USFWS	DNREC, NJDEP, Audubon Society, Tri-State	10						✓	✓		10	0		In-kind services	USFWS, DNREC, NJDEP, Audubon, Tri-State
Total Person Weeks =				52								Total Cost Quarters 1-8 =		\$82,000		

Major Shipping Channels and Dredged Material Disposal Areas Pea Patch Island Heronry Region

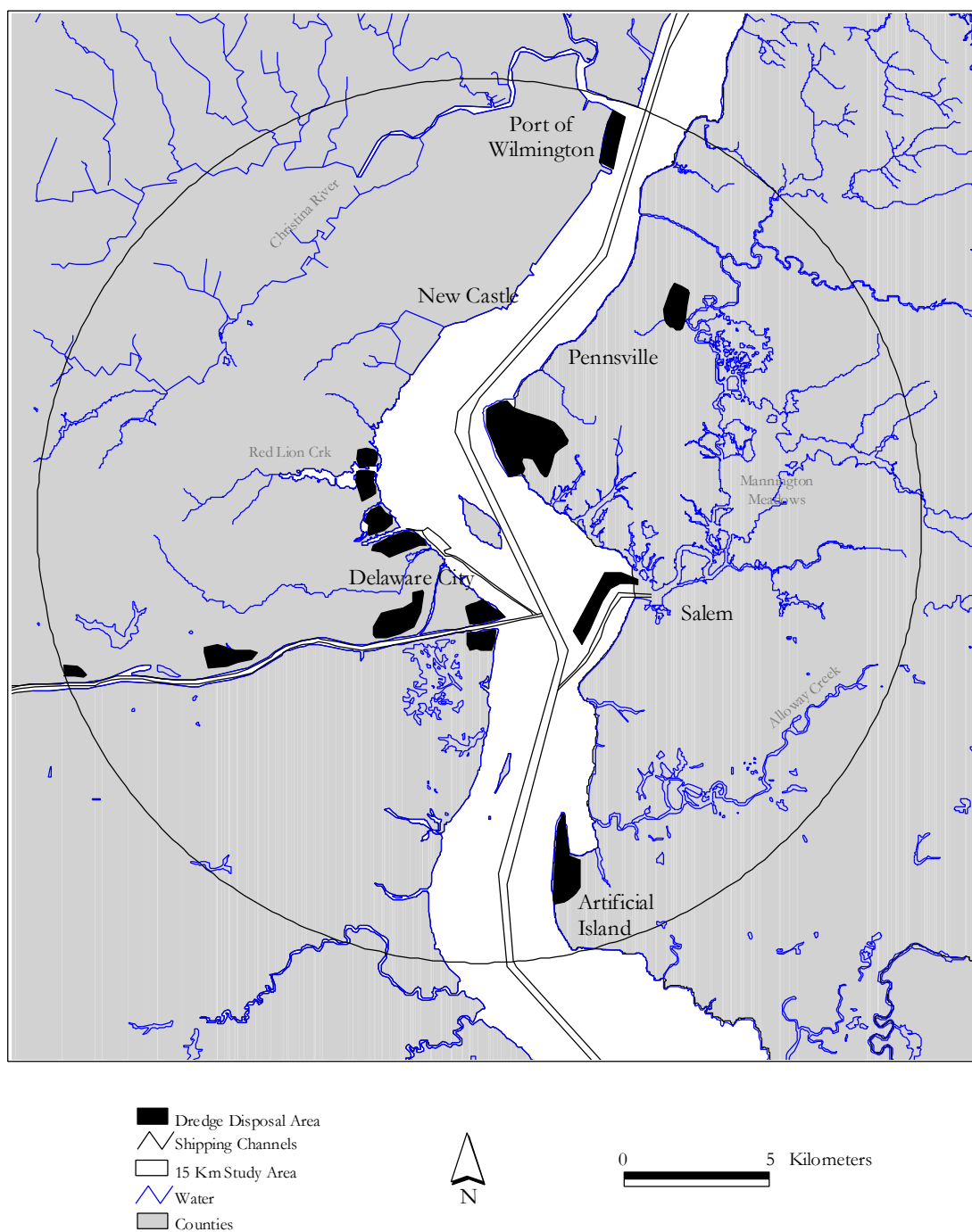


Figure 7. Dredging for commercial shipping occurs on a regular interval of 1-2 years within the Pea Patch Island Heronry Region. Immediately adjacent to the Island are three federally maintained navigation channels: The Delaware River & Bay Main Channel, the Chesapeake & Delaware Canal, and the Salem River Channel. There is an additional channel nearby that is privately maintained by Star Enterprise. All four of these channels require regular maintenance in order to maintain their authorized depths. Dredged material from periodic maintenance is primarily disposed of in upland disposal areas depicted in this map. *Map created by the Delaware Coastal Management Program.*

HABITAT IMPROVEMENT & PROTECTION

Description

The colonization and continued use of Pea Patch Island as a heronry depends on the quantity and quality of two uniquely different habitat types: foraging habitat and nesting habitat. Although historically, the region's combination of a series of "islands" of suitable nesting habitat surrounded by fertile tidal wetlands provided an ideal setting for the establishment of a heron colony, ecological changes and human pressures have reduced the quantity and degraded the quality of these habitat types. To ensure the longevity and stability of the Pea Patch Island Heronry, it is essential that suitable foraging and nesting habitats be protected, restored, enhanced, created and managed for wading birds as well as other species of the Delaware Estuary.

Discussion

Foraging Habitat. Colonial wading birds on Pea Patch Island disperse into the surrounding region to acquire food in a variety of shallow water areas, including: tidal and non-tidal rivers and creeks, ponds, impoundments, flooded fields, and freshwater, brackish and salt marshes. An exception is the cattle egret, which primarily uses open upland areas such as agricultural fields, pastures, roadsides, and lawns as its primary foraging habitat. But wetlands, especially coastal wetlands, provide the majority of foraging habitat for these large birds.

During most of the year, an individual heron, egret, or ibis may wander many miles from roost sites in search of food. During nesting season (March-August) foraging habitat is restricted to the vicinity of the nesting colony. Birds must find enough food not only to sustain themselves but also raise their young. Nesting colony locations are believed to be selected, in part, by the availability of nearby foraging habitats where large amounts of food can be caught easily. Because of the variety of hunting techniques and prey species utilized by wading birds, a wide variety of foraging habitats must exist within a short distance of a nesting colony.

Losses of tidal wetland in the two counties within the PPIHR between the mid 1950's and late 1970's exceed 6,000 acres for New Castle County, DE (Tiner 1985) and 10,000 acres for Salem County, NJ (Ferrigno et al. 1973). These losses represent a 27% and 29% decrease in wetland areas available for heron foraging in New Castle and Salem Counties, respectively.

Nesting Habitat. Colonial wading birds typically build nests in trees and shrubs, but a variety of nesting habitats are used, including phragmites stands. The location of the colony is thought to be chosen to reduce the disturbance of the colony by predators and humans and to be in the vicinity of adequate sources of food to raise nestlings. The most successful and persistent colonies were historically located near the coast in isolated areas near a variety of alternative foraging habitats with abundant prey. Coastal development has eliminated most of these colonies. Today, nesting colonies are more frequently found on islands, including man-made islands such as Pea Patch Island, enlarged by the placement of dredged material in the 1920's.

Historically, small heronries in the region included colonies at such sites as Dragon Run, Thousand Acre Marsh, Killcohook Wildlife Coordination Area, and most recently, Augustine Creek (Cumple Woods). Today, there are only two known heronries in the area: Pea Patch Island and a great blue heron colony on Cypress Branch, Delaware. The reasons for the abandonment of these historical heronries involve speculation and include such causes as human disturbances or development pressure in adjacent areas,

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

vegetation destruction by the herons themselves, and excessive predation or displacement by another species, i.e., bald eagles.

The lack of heron colonies in the Delaware Estuary emphasizes the need for protection or enhancement of other suitable sites, as the permanency of the heronry is also susceptible to abandonment due to either natural (predation or excessive guano deposition) or manmade (catastrophic oil spill) factors. If other sites are not made available and the heronry at Pea Patch Island were destroyed or abandoned, then the regional population could be seriously impacted or lost.

Ongoing Activities. Initiatives that address heron-specific habitat improvement and management issues within the Pea Patch Island Area can be categorized into four broad methods: rehabilitation, management, creation, and protection.

Ongoing activities include:

- Creation of small wetlands associated with wetland mitigation projects.
- Development of a Wetlands Compensatory Mitigation Banking Agreement for the State of Delaware.
- Identification of State Resource Areas (SRA), the largest and most important tracts of natural areas and open space left in Delaware, for protection and acquisition.
- Restoration efforts conducted by DNREC's Northern Delaware Wetlands Rehabilitation Program (NDWRP) and the PSE&G's Estuary Enhancement Program (EEP).
- Fee simple acquisitions by a governmental agency or private conservation organization and the protection of land through private landowner deed restrictions or conservation/habitat agreements.

Sources of Concern

Degraded Wetland Foraging Habitat. An estimated 27,000 acres of tidal wetland habitat has been severely degraded within the PPIHR; however, flight line and foraging studies have shown that these wetlands are extremely important to the herons and probably essential to the future of the Pea Patch wading bird colony. To ensure the longevity of the heronry it is essential that these and other potential foraging sites be improved, protected, and managed in a manner beneficial to the heronry, without being unacceptably detrimental to other wetland organisms, values, and functions.

Shortage of Alternate Nesting Areas. Emphasis on alternate sites should include protecting and enhancing existing suitable sites within the region and creating new sites.

Lack of Knowledge of Heron Requirements. A prerequisite to improving and managing habitat is knowledge about the specific habitat requirements of all species being managed for. Decisions will be made based on the best available information, while researchers continue to fill in the missing gaps.

The survey methodology for determining population estimates of the heronry has greatly improved over the years. However, because of changes in the methodology, chronological gaps in the data, and inherent noise in the data sets we still have difficulty in assessing long-term trends of the heronry's population size, species composition or the cause-and-effect factors that drive these population fluctuations. Although better and longer-term population data is undoubtedly needed, this lack of information should not diminish the current concerns for or importance of the heronry.

New Science of Wetland Rehabilitation. Wetland rehabilitation is a relatively new science in Delaware, as well as the nation. Rehabilitation efforts in the PPIHR were not initiated until the late 1980's, with most large-scale efforts occurring in the mid 1990's. With most of these restoration programs in their infancy, we need to determine their long term benefits and impacts. Emphasis should be placed on monitoring changes over

time while continuing to modify rehabilitation plans as more is learned about how best to improve and manage these sites. As more knowledge is obtained about foraging requirements and preferences of wading birds, this information should be integrated into existing management practices to the extent practicable, and in relation to their compatibility with other multiple-use objectives and wetland functions and values.

Recommended Targets and Strategies

Sixteen targets were developed by the Habitat Improvement and Protection Group at the Issue Characterization Workshop in December 1996. These are described in the *Pea Patch Island Special Area Management Plan: Issue Characterizations*. Descriptions for 17 of a total of 21 DRAFT management strategies to address these targets were developed during and immediately after the Strategy Development Workshop held on April 2, 1997. A subset of 5 strategies were identified to be moved forward in the process for more refined thinking and description of implementation details. The targets and strategies being addressed are:

- HI-1** Securing Landowner Cooperation or Land Access/Control for Wetland Restoration Projects.
- HI-2** Reduce Phragmites and Other Nuisance Species by 3,000 Acres Throughout the Pea Patch Island Heronry Region Within 5-10 Years.
- HI-3** Review Existing Restoration and Wildlife Plans for Pea Patch Island Needs and Benefits.
- HI-4** Regenerate and Perpetuate Nesting Habitat on the Island Within Five Years.
- HI-5** Develop Specific Criteria for Heronry Requirements for Use in Land Acquisition and Protection.

Strategy HI-1 Secure Landowner Cooperation or Land Access/Control For Wetlands Restoration Projects

Activities:

- Identify the legal ability of public resource management agencies to restore or manage the coming and going of tides over private wetlands.
- Develop a legally binding agreement form.
- Assess the potential for achieving cooperative agreements through landowner organizations.

Participating Institutions:

- **Delaware Department of Natural Resources & Environmental Control**
 - Division of Fish and Wildlife
 - Division of Soil and Water Conservation
 - Division of Parks and Recreation
- **New Jersey Department of Environmental Protection**
 - Division of Fish and Wildlife
 - Land Acquisition Program
- **United States Fish and Wildlife Service**
 - Delaware Bay Estuary Project
- **Delaware Office of Attorney General**
- **New Jersey Office of Attorney General**
- **New Castle County Conservation District, Delaware**
- **Salem County Conservation District, New Jersey**

Schedule: Activities will take up to two years for completion.

Cost: \$45,000.

Resource management agencies often spend a tremendous amount of energy on trying to define “what” wetlands restoration is, and on “how” its to be done. This effort is often repeated on a site-specific basis, without first being sure that the agencies have some type of access to, or control of, the lands where the proposed work is to be done. Some on-going wetlands restoration projects are on the verge of being stalled, or are not proceeding as rapidly as desired, because of unresolved issues with landowners. Other restoration projects are not started because of these concerns. Considerably more effort and thought has to go into developing and applying mechanisms to secure landowner cooperation or some other type of land access/control. This is particularly true for restoration sites involving impounded wetlands on private lands, which constitute a lot of potentially valuable wetlands in the PPI region. This strategy should result in guidance for public resource management agencies as to how to best proceed in choosing options to gain landowner cooperation or land access/control on a site-by-site basis. Additional information regarding land

management issues in New Jersey may be necessary to successfully meet the objectives of this strategy in that state.

Primary Activities

Activity 1. Identify the legal ability of public resource management agencies to restore or manage the coming and going of tides over private wetlands. Definitive legal opinions should be sought from the Attorney General offices in both Delaware and New Jersey about the legal limits or boundaries to actions that could be unilaterally taken by DNREC or NJDEP to restore tidal flows to coastal private wetlands that naturally should be tidal and/or to manage tidal flows at such private sites via publicly-owned water control structures sited on publicly-owned lands. We have to find out the legal rights and abilities of a resource management agency for proceeding with tidal wetlands restoration project in situations where not all private landowners are cooperative, and/or where the lands cannot be acquired (because of lack of funds or unwilling sellers). A private landowner's reluctance to participate in wetlands restoration will have direct negative impacts on public issues or resources (e.g. water quality, fish and wildlife habitats and populations, need for mosquito control) if such reluctance stops the project. DNREC has already taken some steps to explore this legal issue, but more has to be done. Legal issues or topics that are involved here include in part: trespass, taking without just compensation, police powers, prescriptive easements, condemnations, proving damages, equitable estoppel, etc. However, just because proposed agency actions are determined to be legal, it does not mean these actions will be politically possible.

Activity 2. Develop a legally binding agreement form. Develop a widely applicable, voluntary, cooperative agreement form that is legally binding between landowners and the public agencies responsible for wetlands restoration projects. Examine the potential of the USFWS's Habitat Restoration Agreement as a possible model. In many cases, it's possible to get voluntary cooperation/permission from private landowners to proceed with a wetlands restoration project. This is often done in partial exchange for giving landowners management practices that they strongly desire. However, before an agency proceeds to spend significant resource on undertaking restoration work, it's very wise and desirable to signify this voluntary cooperation and commitment via some type of long-term, legally-binding cooperative agreement between the landowner and agency. This would prevent a landowner from changing his/her mind after significant public resources have been spent. Efforts should be taken to develop a widely applicable cooperative agreement form in terms of its style, content and legality.

The USFWS has created and used a similar agreement form for several years as part of the Partners for Wildlife project. Through a legally binding Restoration Agreement between the landowner, USFWS, and/or other designated partners of the Service (such as the appropriate state fish and wildlife agency), habitat restoration actions can be undertaken for a minimum period of ten years. This tested agreement could be used as a model.

Activity 3. Assess the potential for achieving cooperative agreements through landowner organizations. In some cases it may be possible to secure voluntary cooperation from private landowners by working through an organization of landowners rather than with individual landowners, if such an organization exists. DNREC is pursuing a "test case" at the 1000 Acre Marsh site to see if a modified concept for the traditional uses of a "tax ditch association" can be used. Other types of landowner organizations such as a watershed association might also be considered. Further assessments of the potential and opportunities for using landowner organizations are needed. However, it must be kept in mind that landowner associations, which in some forms might actually become new entities of government, are still assemblages of private landowners who will usually be operating in what they perceive to be their own best interests, which does not always coincide with the public best interests. There are some potential legal complications here.

Implementation

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

Institutional Responsibilities

The primary lead for implementation in Delaware will be DNREC with support from the Delaware Attorney General's office. Similarly, the primary lead for implementation in New Jersey will be NJDEP with support from the New Jersey Attorney General's office.

Schedule

The legal review (Activities 1-3) could take an estimated 1 to 2 years to complete. Activity 1 has been partially investigated already by DNREC. DNREC also has some initiatives underway to address Activity 2 (at Augustine Creek Marsh) and Activity 3 (at 1000 Acre Marsh). For the proposed schedule according to activity, see Table 25.

Location

This strategy will focus on proposed wetland restoration sites in Delaware and New Jersey.

Costs and Funding

This strategy will primarily involve staff time and legal research expenses to assess, refine and better describe the legal options to allow the practical application and implementation of wetland restoration in the field. This will require largely staff and volunteer time. See Table 25 for the anticipated cost of each activity and potential funding sources.

Financing of the legal assessment activities is anticipated to come from DNREC and NJDEP general funds, or from federal grants.

Existing programs

Several programs, including DNREC's Northern Delaware Wetland Rehabilitation Program, deal specifically with wetland restoration projects in Delaware. In New Jersey and Delaware, PSE & G's Estuary Enhancement Program has undertaken significant marsh wetland restoration projects. Both Delaware and New Jersey have existing laws and regulations that are pertinent to Activity 1, policies and regulation pertaining to land acquisition, and existing laws, regulations, and policies relevant to the creation and functioning of landowner associations. The USFWS has been using a Habitat Restoration agreement form for several years as part of their Partners for Wildlife projects.

Performance Measures

Performance measures include the achievement of new wetland restoration projects and the reduction of problems with landowner cooperation or land access/control.

Review/Key Decisions

Existing programs and authorities that would need to be encompassed in review and decision making for Activities 1-3 are: Delaware Department of Natural Resources and Environmental Control, New Jersey Department of Environmental Protection, Delaware Attorney General Office, and the New Jersey Attorney General Office.

Strategy HI-1 -- Secure Landowner Cooperation or Land Access/Control for Wetlands Restoration Projects

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Identify the legal ability of public resource management agencies to restore or manage tides over private lands.	DNREC, NJDEP	DE and NJ Attorney General	26	✓	✓	✓	✓	✓	✓	✓	✓	40	0	✓		DCMP, DE and NJ F&W
2. Develop a legally binding agreement form.	DNREC, NJDEP	DE and NJ Attorney General	1	✓	✓	✓	✓					1	0	✓		DCMP, DE and NJ F&W
3. Assess the potential for achieving cooperative agreements through landowner organizations.	DNREC, NJDEP	DE and NJ Attorney General	4					✓	✓	✓	✓	4	0	✓		DCMP
Total Person Weeks = 31				Total Cost Quarters 1-8 = \$45,000												

Strategy HI-2

Reduce Phragmites and Other Invasive Species by 3,000 Acres Throughout the PPIHR Within 5-10 Years

Activities:

- Map the extent of phragmites (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*) within the PPI region.
- Assemble information on methods and timing for phragmites and purple loosestrife control.
- Secure funding for control from state agencies, federal programs and other sources.
- Obtain permission to conduct control activities on affected marshes.
- Implement control programs and any follow-up applications as needed.
- Adjust the program as indicated by the monitoring results.

Participating Institutions:

- Delaware Department of Natural Resources and Environmental Control
Division of Fish and Wildlife
- New Jersey Department of Environmental Protection
- U.S. Fish and Wildlife Service
- Delaware Department of Agriculture
- New Jersey Department of Agriculture
- United States Department of Agriculture

Schedule: Initial planning activities should take one year. Treatments will be necessary on an annual basis at first, follow up treatments will be on an as needed basis for at least 10 years.

Cost: \$120,000

Phragmites and purple loosestrife have become invasive plant species in the wetlands of the Delaware Estuary over the past several decades. Phragmites forms monotypic stands that crowd out other desirable plant species, reducing the quality of wildlife habitat, and altering marsh elevations and tidal water distribution throughout the marsh. Control of phragmites is achieved by a late summer application of glyphosate herbicide that must be repeated again the following year. Used in combination with prescribed burning between the first and second year application, this technique has been effective. To date there has been little effort specifically expended to control purple loosestrife in the Delaware Estuary. Because of the difficulty of control of this species, this strategy recommends is to attempt the biological control of the plant by introduced insects, because herbicide control is much more difficult. This approach is being currently tried in the Midwest. If successful, this would be a much more cost-effective method of achieving control of purple loosestrife. Both of these control efforts are needed to reduce the amount of phragmites and purple loosestrife present in the estuary and to increase the amount of available, quality wetland habitat over the

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

next 10 years. This effort would benefit many different species of wetland dependent wildlife, including the long-legged wading birds of Pea Patch Island.

Primary Activities

Activity 1. Map the extent of phragmites and purple loosestrife within the Pea Patch Island Heronry Region. Update (or create as needed) a GIS map layer of the extent of phragmites and purple loosestrife coverage in New Castle and Salem Counties, with an emphasis on the PPIHR. Identify and map any new, potentially invasive species within the same area. These maps should use the latest aerials available (1996 in Delaware). Wetlands should be ground-truthed to confirm the presence of these species. This will be particularly important for purple loosestrife, which is generally not visible in aerials.

Activity 2. Assemble information on control methods and timing for phragmites and purple loosestrife. Assemble information on control methods and timing for phragmites and purple loosestrife with both a monetary and environmental cost/benefit analysis. Review current knowledge about the efficacy of controls for phragmites and purple loosestrife. Generate financial cost estimates for long-term management of these species. Consider the benefits and costs to the environment of the selected treatment methodology, such as limiting non-target damage.

Activity 3. Secure funding for control techniques from state agencies, federal programs and other sources. This funding should be considered an annual expenditure. The annual cost of maintaining quality habitats in the estuary will be significantly less than the cost of restarting a control program after a decade of neglect, which would allow these plant species to become reestablished.

Activity 4. Obtain permission to practice control activities on affected marshes. Find a way to incorporate privately-owned marshes that have not yet participated in the cost share phragmites control programs.

Activity 5. Implement control programs and any follow-up applications as needed.

Activity 6. Adjust the program as indicated by the monitoring results. Monitoring the results of the control treatments is absolutely vital to measure the success or failure of treatment methodologies over the long term. It also leads to increased efficacy and knowledge regarding the control of these invasive plants and the overall increased health of the wetlands they have invaded. Without accurate monitoring of the program, long-term funding will likely disappear.

Implementation

Institutional Responsibilities

In the PPIHR, the primary lead for implementation will be DNREC's Division of Fish and Wildlife which has over 15 years of phragmites control experience. Significant additional support has been supplied by PSE&G's Estuary Enhancement Program. NJDEP is the lead agency in New Jersey.

Schedule

The Delaware Division of Fish and Wildlife has conducted aerial spraying of phragmites on publicly owned marshes since the 1980's. Many more acres of phragmites are scheduled to be treated this year. In New Jersey, PSE&G's Estuary Enhancement Program has targeted thousands of acres of wetland restoration projects; including several projects within the PPIHR. These projects, which include control of phragmites as one of their objectives, are underway. See Table 26 for the proposed schedule according to activity.

Location

Implementation of the strategy will include wetlands in New Castle County and Salem County, wherever these invasive plant species threaten the biological diversity of the wetlands they are found in. Treatment priority should be first given to the area within the PPIHR*, but not limited to this area.

**Note that there presently are no plans to remove the phragmites from around the Pea Patch Island rookery because several species of long-legged waders use the phragmites for nesting habitat on the island.*

Costs and Funding

Funding for this strategy could cost up to \$30,000 for completion of the initial mapping and associated groundwork in both states. Overall treatment expenditure including: aerial herbicide applications, pest beetle introductions for purple loosestrife, follow-up spot treatments from the ground, and prescribed burning of previously sprayed marshes; are expected to be approximately \$70,000 per year until all the targeted control locations have been treated for at least two years. Annual expenditures would then fall to a spot-treatment level estimated to be 1/2 of the previous control level. See Table 26 for costs and funding resources associated with each activity.

Financing of this strategy is anticipated to come from state and federal agencies, as well as private landowners.

Existing programs

In addition to the phragmites control program on public lands, the Delaware Division of Fish and Wildlife Cost Sharing Program extends the existing spraying opportunity to private landowners as well on a 50/50 cost basis. PSE&G's Estuary Enhancement Program includes a phragmites control component. USFW's Partners in Wildlife and USDA's Wildlife Habitat Incentive Programs both support habitat improvements on private lands that include phragmites control.

Performance Measures

Performance measures will include the reduction of existing phragmites cover by 95% within the PPIHR from the highest cover densities recorded before the first control efforts began in the 1980's. Actual reductions in the cover of phragmites and purple loosestrife must be determined by establishing a monitoring program to measure the efficacy of the both the herbicide and biological control programs. Purple loosestrife must not become a major component of these marshes as a result of the removal of phragmites.

Review/Key Decisions

Existing programs and authorities that would need to be involved in review and decision making are primarily Delaware Department of Natural Resources and Environmental Control and New Jersey Department of Environmental Protection, with the coordination and cooperation of Public Service Electric and Gas.

Strategy HI-2 -- Reduce Phragmites and Other Invasive Species by 3,000 Acres Throughout the PPIHR within 5-10 Years

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Map the extent of phragmites and purple loosestrife within the PPIHR.	DNREC, NJDEP	USFWS, USDA	20		✓	✓						30			✓	DELEP, PSE&G, USFWS, DE and NJ F&W
2. Assemble information on methods and timing for control.	DNREC, NJDEP	USFWS, USDA	10	✓								10			✓	DE F&W
3. Secure funding for control from state agencies, federal programs and other sources.	DNREC, NJDEP	USFWS, USDA	5	✓								5			✓	DELEP, DE and NJ F&W
4. Obtain permission to conduct control activities on affected marshes.	DNREC, NJDEP	USFWS, USDA	1		✓							5			✓	DELEP, DE and NJ F&W
5. Implement control programs and any follow-up applications as needed.	DNREC, NJDEP	USFWS, USDA	3						✓	✓		70	70		✓	DELEP, DE and NJ F&W
6. Adjust the program as indicated by the monitoring results.	DNREC, NJDEP	USFWS, USDA											4		✓	DELEP, DE and NJ F&W
Total Person Weeks = 39				Total Cost Quarters 1-8 = \$120,000												

Strategy HI-3 Review Existing Restoration and Wildlife Plans for PPI Needs and Benefits

Activities:

- Establish working committees of technical experts in Delaware and New Jersey, to review, evaluate and make recommendations as appropriate regarding long-legged wading bird needs/conservation.
- Identify existing wildlife/habitat management plans within the PPI Heronry Region.
- Schedule a plan, review time frame, and protocol.
- Provide a written report and meet with landowner/managers to discuss recommendations and comments.
- Develop a funding or in-kind service method to help implement plan recommendations.
- Monitor and review the revised management plan at a set interval (e.g. every five years).
- Maintain a written record of active management implementation and results.
- Develop a commitment to long term funding of the review process.
- Coordinate with environmental education/outreach staff to effectively disseminate new information.

Participating Institutions:

- **Delaware Department of Natural Resources & Environmental Control**
- New Jersey Department of Environmental Protection
- U.S. Fish & Wildlife Service
- Delaware Wildlands, Inc.
- Delaware Estuary Program
- New Jersey Public Service Electric & Gas

Schedule: This strategy could conceivably begin within a short time frame once the various key institutions agree to participate (six months or less). When the initial plan review process begins, it will not end until all existing plans are reviewed. Thereafter, when new plans are developed, or existing plans revised, the technical group would reconvene to review the newly proposed plan.

Cost: \$22,000.
Annual costs will range from \$0 to \$2,000.

This strategy proposes establishing technical committees in New Jersey and Delaware respectively. Both of these technical committees would evaluate existing wildlife and habitat management plans and, where appropriate, make recommendations for incorporating management components which address the conservation needs of the long-legged wading birds which nest and forage within the PPIHR. Plans reviewed would include those generated by local, state and federal entities and, where appropriate, private entities (e.g. corporate landowners, private conservancies, and other private landowners). Topics to be addressed include but are not limited to: water level management (impoundments), buffers, herbaceous and woody vegetation management (burning, chemical and mechanical treatments, methodology, locations, and

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

timing), human disturbance/access issues, and predator issues. While this process is intended to highlight long-legged wading birds needs and conservation objectives, the intent is to integrate these needs into existing multiple objective plans. Priority given to long-legged wading birds' requirements may depend in part on how critical the resources in question are to the long-legged wading birds in the framework of the PPIHR. Emphasis will be placed on providing technical assistance and helping to devise sound integrated approaches in cooperation with the landowners and/or managers. An effort will be made to consider any individual site management plans in context of the larger PPIHR. This should be considered an on-going process as newer plans are developed for existing or newly acquired lands, as additional landowners become interested in evaluation, as better information becomes available, and as changing conditions indicate that re-evaluation is necessary.

Primary Activities

Activity 1. Establish working committees of technical experts in Delaware and New Jersey, to review, evaluate and make recommendations as appropriate regarding long-legged wading bird needs/conservation. These committees are not regulatory in nature, but technical groups of experts that can make habitat management recommendations regarding the herons, egrets and ibis populations in their respective states. Recommendations will not be binding unless the receiving entity (by policy or law) has deemed it so.

Activity 2. Identify existing wildlife/habitat management plans within the PPI Heronry Region. Sources of all existing management plans, which include state wildlife areas, state parks, and federal refuges, as well as private holdings, should be identified for potential review.

Activity 3. Schedule a plan, review time frame, and protocol. Establish a review schedule, including target dates for review completion, of the identified management plans using a broad prioritization scheme that recognizes the urgency or potential of an important positive or negative impact to PPIHR long-legged wading birds.

Activity 4. Provide a written report and meet with landowner/managers to discuss recommendations and comments. Once a management plan review is completed, a written report describing the conclusions must be provided to landowner/managers with clear justifications for any recommendations. A meeting with landowner/managers to discuss the technical committee's recommendations must follow written reports. The objective of the meeting is to integrate these recommendations into the existing multiple objective goals of the plan, both spatially and temporally in the context of the PPIHR.

Activity 5. Develop a funding or in-kind service method to implement plan recommendations. Funding will be one of many considerations prior to the implementation of any new technical committee recommendations. Where possible, the committee should provide assistance to landowner/managers either directly or by referral, re: available cost share programs, funding sources, in-kind services, incentives, or other appropriate measures.

Activity 6. Monitor and review the revised management plan at a set interval (e.g. every five years). Assuming some revisions are made to a given management plan and put into effect by the landowner/manager, the management recommendations of the technical committee should be monitored by the landowner/managers to determine their efficacy. A subsequent evaluation of the results of any management changes by the technical committee and the landowner/managers is recommended on a three to five year basis.

Activity 7. Maintain a written record of active management implementation and results. Maintain a clear written record of the review process for future reference.

Activity 8. Develop a commitment to long term funding of the review process. Recognize that this is an on-going process and that ongoing funding for reviewer time, travel, photocopying and report production will be needed, as

well as support from each reviewer's employers to dedicate time for the evaluations, re-evaluations, and dissemination of new and better information.

Activity 9. Coordinate with environmental education/outreach staff to effectively disseminate new information. Coordinate with those conducting outreach to private landowners to inform these land managers of availability of technical assistance, making sure that the key public lands have already been addressed and that the technical committee is able to take on the additional workload.

Implementation

Institutional Responsibilities

The primary lead for implementation will be DNREC and NJDEP, with support from other public and private organizations within each state that would supply staff and support to the technical committees in New Jersey and Delaware.

Schedule

This project will take a minimum of six months to initiate. An ongoing review process of new and existing management plans will be conducted annually until all plans are reviewed. Re-evaluations of plans that have implemented technical committee recommendations will be conducted on a three to five year cycle. See Table 27 for the preliminary schedule according to activity.

Location

One committee will be located in New Jersey and one in Delaware. Although primarily focused on the PPIHR, these committees could review plans affecting the entire Delaware estuary in the respective states.

Costs and Funding

This strategy will cost an average of \$1,000 to \$10,000 annually for each state to support the technical committee functions. Financing of this strategy is anticipated to come from government funding sources, federal, or private grant programs. See Table 27 for costs and funding sources associated with each activity in this strategy.

Existing programs

These existing programs manage wetlands within the PPIHR. Some or all of these organizations have technical experts that could contribute staff to a technical committee. These agencies and organizations include DNREC Divisions of Fish and Wildlife and Parks and Recreation, NJ Division of Fish, Game and Wildlife, USFWS, Delaware Wildlands, Inc., PSE & G, and Star Enterprises.

Performance Measures

The technical committees should complete the review of four management plans per year until all the management plans have been reviewed. The committees' work will be successful when a demonstrable willingness from a wide assortment of public/private agencies, organizations and individuals to work cooperatively to improve, protect and enhance long-legged wading bird conservation within the PPIHR is achieved.

Review/Key Decisions

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

Existing programs and authorities that will need to be encompassed in review and decision making are; Delaware Department of Natural Resources and Environmental Control, New Jersey Department of Environmental Protection, Delaware Estuary Program, and the US Fish & Wildlife Service.

Strategy HI-3 -- Review Existing Restoration and Wildlife Plans for PPI Needs and Benefits

Strategy HI-3 -- Review Existing Restoration and Wildlife Plans for PPI Needs and Benefits

Strategy HI-4 Regenerate and Perpetuate Nesting Habitat on the Island Within 5 Years

Activities:

- Survey the existing forest community to establish a forest model of community composition, structure, and utility as nesting substrate for the heronry.
- Control erosion of existing island substrate.
- Remove/control herbivores to reduce stress on the existing vegetation and the planted vegetation.
- Remove/control competing exotic vegetation from the heronry forest (e.g., *Ailanthus altissima*).
- Develop a phased revegetation plan that takes into account the season of planting, physical and logistical site constraints, ecological goals and costs.
- Begin first phase of replanting un-vegetated areas based upon the established model, test planting, and timetable.
- Examine the continued use of phragmites as nesting substrate, as forest diversity and acreage increases over time.
- Monitor the plantings and adjust the planting plan accordingly.

Participating Institutions:

- **Delaware Department of Natural Resources & Environmental Control**
 Division of Parks and Recreation
 Division of Fish and Wildlife
- Manomet Center for Conservation Sciences
- United States Fish & Wildlife Service

Schedule: The initial survey of the heronry forest (Activity 1) will begin as soon as funding can be obtained. A proposed planting plan, including a test planting, is projected to be completed within a year of the initial survey. Additional fall plantings will proceed annually until the plan is completed. Management of the vegetation within the heronry will be ongoing.

Cost: \$100,000 - 500,000.

The long-term health of the forest on the northern end of Pea Patch Island has been of concern to biologists since the heronry was first studied in the 1970's. Predictions, at that time, of the ultimate destruction of the nesting substrate on the island have not yet occurred. Although most of the trees and shrubs are still alive, some are in poor health and some are flourishing. There is still concern that the forest may yet be in trouble. Numerous trees have died in recent years, presumably because of altered soil chemistry immediately beneath nesting sites due to the enormous amount of excrement and other organic materials contributed to the soil.

In addition, the successful reproduction of the plants has also been limited for several reasons. First, an abnormally high deer population (nearly 100) was eating everything under four feet in height on the island. Despite consuming everything they could reach, the deer were malnourished and unhealthy. This situation

improved when a controlled hunt was held several years ago that significantly reduced the deer herd to 15 to 20 animals. Although this has removed some of the pressure on the trees and shrubs, there are still too many deer on the island to allow significant reproduction in the forest. Second, two large, circular areas in the middle of the island seem incapable of supporting a forest. These areas are covered in gravel and large cobble with very little soil on the surface. Grasses and other forbs sparsely cover these open areas. Scattered shrubs and trees apparently grow only in low depressions that collect soil and rainwater. We need to ascertain the reason for the lack of forest in this area, or a replanting here will likely fail even if the deer are no longer a problem.

The forest became established on the portion of Pea Patch Island created by the Army Corps of Engineers subsequent to 1903-04 following the deposition of channel dredge spoil when the Delaware River Channel was deepened to its present depth of 40 feet. It is probable that these gravel areas have never supported a forest. The two donut shaped rings of forest that comprise the heronry completely surround these almost barren gravel areas. A mistaken perception is that the bird's excrement has killed trees in these areas.

Each species of bird in the heronry uses slightly to significantly different nest sites. They often rotate between different sites on the island from year to year, choosing small trees and shrubs of different species as a nesting location one year, and other years using the adjacent phragmites marsh. It has been speculated that the lack of nesting sites in the trees and shrubs is a limiting factor to the success and size of the heronry. It must be realized that the regeneration and perpetuation of the nesting habitat is a long-range approach that attempts to ensure the perpetuation of the Pea Patch Island heronry. It should not be viewed as an attempt to attract more birds. Any and all work done on PPI will not guarantee the continuation of the current rookery. However, the re-establishment or establishment of preferred nesting substrate on the island, in addition to providing maximum seclusion from predators and humans, may allow the perpetuation of the rookery if strategies that protect the birds foraging habitat are also successful.

Primary Activities

Activity 1. Survey the existing forest community to establish a forest model of community composition, structure, and utility as nesting substrate for the heronry. A vegetation survey of the heronry to establish a permanent baseline of what is currently growing on the island must be completed. This information will be used in combination with historical photographs, vegetation data collected by J. H. Weise in 1979, and nesting substrate usage data collected by Manomet Center since 1992, to provide a picture of forest changes over time. Literature will be reviewed to consider the possibility that the 'donut forest' is more attractive to some or all of the species of birds in the rookery than a complete forest cover would be. Soil tests will be conducted within a variety of sites in the rookery, including the un-vegetated areas, to determine suitability for planting. A test planting will be scheduled if the soil conditions prove appropriate. This data, plus information regarding the historic vegetation cover of mid-Atlantic heronries, will be used to develop a forest model for the heronry that will be used to establish management guidelines.

Activity 2. Control erosion of existing island substrate. Controlling the current erosion of the island is an important component of protecting the rookery. Consultants hired by DNREC's Division of Parks and Recreation are currently studying the erosion processes on the island and will be offering suggestions for the protection of the entire island in the fall of 1997. Currently, the focus on the island's erosion problems is centered on the southern, historic part of the island, which is losing nearly 5 feet per year. This activity will measure the erosion rates within the rookery on a year to year basis to determine how much land area is being lost.

Activity 3. Remove/control herbivores to reduce stress on the existing vegetation and the planted vegetation. Following the recent culling of the deer herd on the island, DNREC's Division of Fish and Wildlife has managed deer hunts on the island on an annual basis. The deer herd remains at an estimated 15 to 20 animals. The size of the deer has returned to normal, indicating that the deer are no longer starving, but the herd is still too large

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

for the size of the island. It may be nearly impossible to completely remove the deer from the island, but an increased effort to further reduce the size of the herd will be explored with the Division of Fish and Wildlife. Vegetation monitoring will measure the annual recruitment of seedlings into the forest. Deer could prevent a successful revegetation effort.

Activity 4. Remove/control competing exotic vegetation from the heronry forest (e.g., *Ailanthus altissima*). Exotic species are not a major component of the forest in the heronry, but some species have become established in the forest. One of these, the tree of heaven, also known as ailanthus, has become the dominant tree in the forest on the historic part of the island. Ailanthus has an open crown structure that is not conducive to supporting the large bulky stick nests of the long-legged wading birds in the heronry. This tree must not become established on the site, for it will take the space of more beneficial native trees capable of supporting nests. These invasive exotic plants will be eliminated as part of the management plan for the rookery.

Activity 5. Develop a phased revegetation plan that takes into account the season of planting, physical and logistical site constraints, ecological goals and costs. Following the establishment of a forest model for the rookery, develop a detailed, phased revegetation plan based upon the model, recommendations of Manomet Center, and logistical and ecological constraints. Acquire approval of the Natural Areas Advisory Council who manages the state's Nature Preserve system and the SAMP Implementation Team.

Activity 6. Begin first phase of replanting un-vegetated areas based upon the established model, test planting, and timetable. The planting will proceed on a yearly basis to develop an uneven age forest. Phasing the planting will allow for adjustments to the revegetation plan on a year to year basis.

Activity 7. Examine the continued use of phragmites as nesting substrate, as forest diversity and acreage increases over time. Will the long-legged wading birds that currently use the phragmites for nesting habitat continue this use after more trees and shrubs become available? This question can only be answered after several decades with the successful addition of nesting substrate. The birds will answer the question for us eventually, but until then the phragmites border around the heronry will be maintained and not controlled.

Activity 8. Monitor the plantings and adjust the planting plan accordingly. Continue to monitor the existing vegetation as well as the revegetation efforts on a yearly basis.

Implementation

Institutional Responsibilities

The primary lead for implementation will be DNREC Divisions of Parks and Recreation and Fish and Wildlife. Additional support will come from Manomet Center, and the USFWS.

Schedule

The initial survey of the heronry forest will begin when funding is obtained. Other necessary components of the plan, such as soil testing will need to be completed prior to any planting. The proposed planting plan, including a test planting, will be completed within a year of the survey of the heronry forest. Additional fall plantings will proceed annually until the plan is completed. Management of the vegetation within the heronry will be ongoing. See Table 28 for the proposed schedule according to activity.

Location

Implementation of the strategy and all data collection and fieldwork will be done on Pea Patch Island.

Costs and Funding

This strategy will require approximately \$300,000 over the course of five years if all eight activities are carried out to their fullest extent. Significant progress toward re-vegetating the island can probably be accomplished for less. However, if the soils prove to be unsuitable for growth of the trees and shrubs, the expenses could be well over \$500,000. Financing of this strategy is anticipated to come from government funding sources,

federal, or private grant programs. See Table 28 for costs and funding sources associated with each activity in this strategy.

Existing Programs

There are no existing programs that are operating a revegetation plan like this. However, reforestation efforts have been done by several agencies such as USFWS, DNS, and DNREC.

Performance Measures

Performance measures include a net 20% increase in the available nesting habitat available to the birds. The island will be monitored yearly to determine measure changes.

Review/Key Decisions

Existing programs and authorities that would need to be encompassed in review and decision making are; Delaware Department of Natural Resources and Environmental Control, Manomet Center, and the US Fish & Wildlife Service.

Strategy HI-4 -- Regenerate and Perpetuate Nesting Habitat on Pea Patch Island within 5 Years

Strategy HI-4 -- Regenerate and Perpetuate Nesting Habitat on Pea Patch Island within 5 Years

Strategy HI-5 Develop Specific Criteria for Heronry Requirements for Use in Land Acquisition and Protection

Activities:

- From the available wetland inventories in New Jersey and Delaware, identify all key wetlands important to PPI long-legged wading birds.
- Identify all historic nesting habitats remaining within the PPIHR region.
- Identify upland resources within the PPIHR region that provide important foraging habitat for cattle egrets.
- Identify and characterize wetlands for possible restoration and improvement within the PPIHR.
- Develop specific ranking criteria for foraging and nesting habitats identified, and evaluate the highest rated properties in the land acquisition and land protection programs in Delaware and New Jersey.

Participating Institutions:

- Delaware Department of Natural Resources & Environmental Control
- New Jersey Department of Environmental Protection
- Manomet Center for Conservation Sciences
- United States Fish & Wildlife Service

Schedule: The initial activities should take not more than one year to complete, although the schedule is going to vary between New Jersey and Delaware. Field survey work may require at least two breeding seasons to evaluate and verify all identified sites.

Cost: \$15,000 - \$50,000.

A set of criteria is needed that can target and prioritize lands for acquisition and/or protection that meet the foraging and nesting habitat requirements of long-legged wading birds (herons, egrets, ibis) within the PPIHR of the Delaware Estuary. These criteria could be utilized throughout Delaware and New Jersey as additional ranking criteria for acquisition and/or regulatory protection of critical habitat for these species. By necessity, the criteria must be broad enough to include the spectrum of habitats and associated prey bases utilized by PPI wading birds. It is recognized that the opportunistic nature of these species occasionally, and in the case of cattle egrets, frequently incorporates man-made areas such as lawns, stormwater management ponds, agricultural fields, golf courses and drainage ditches as well as freshwater and brackish wetlands. The focus of the criteria will be upon the important, frequently used habitats, not the occasionally used, more marginal habitat areas.

Primary Activities

Activity 1. From the available wetland inventories in New Jersey and Delaware, identify all key wetlands important to PPI long-legged wading birds. Using the current wetland survey data available in Delaware and New Jersey, identify potential key wetland habitat for PPI long-legged wading birds. Once potentially important habitat for foraging and nesting have been identified, field surveys will be conducted during the next breeding season to

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

confirm the use of habitats by the PPI birds. These surveys must be designed to build on the data already collected by Manomet Center. Data collected for wetlands found to support long-legged wading birds should include the size of wetland, distance from PPI, species using the habitat, available buffer, protective status of the land, as well as flight path information. Manomet Center's experience will be valuable in the design of this survey protocol. Wetlands both inside and outside the artificial PPIHR radius should be examined. The use of volunteers to conduct these initial field surveys could prove valuable.

Activity 2. Identify all historic nesting habitats remaining within the PPIHR region. Identify all the historic and active heronries both within and outside the PPIHR.

Activity 3. Identify upland resources within the PPIHR region that provide important foraging habitat for cattle egrets. Identify upland resources within/outside PPI region that support the largely terrestrial foraging behavior of the cattle egret. What is the primary land use? Should land acquisition and protection programs acquire or protect habitat for this species? Maybe, or maybe not, but since cattle egrets may prove to be the among the best indicator species of environmental health of all the long-legged wading birds, we need to know where they are feeding. Manomet Center's ongoing radiotelemetry study should help in this regard, but an aerial survey, supplemented by ground surveys, may be the only way to monitor the broad dispersal of these opportunistic terrestrial foragers.

Activity 4. Identify and characterize wetlands for possible restoration and improvement within the PPIHR region. Identify all areas within the PPIHR that are currently designated for state/federal wetland mitigation banking. Identify and characterize all private or public wetland restoration activities with the PPIHR such as PSE&G's Estuary Enhancement Program. Identify additional areas that might be available for wetland mitigation banking, and recognize the potential of these sites in the ranking.

Activity 5. Develop specific ranking criteria for foraging and nesting habitats identified, and evaluate the highest rated properties in the land acquisition and land protection programs in Delaware and New Jersey. Develop specific ranking criteria of foraging and nesting habitat such as: overall size and shape of the wetland; amount of upland buffer; restoration potential, high foraging habitat diversity; possible nesting habitat; abundance of prey species; whether the land is protected and/or adjacent to protected land; compatible uses of the wetland; and potential manageability. Incorporate the ranking criteria into the land acquisition/protection programs in Delaware and New Jersey.

Implementation

Institutional Responsibilities

The primary leads for implementation will be DNREC and NJDEP, with support from Manomet Center and USFWS.

Schedule

The initial activities should take not more than one year to complete, although the schedule is going to vary between New Jersey and Delaware. Field survey work may require at least two breeding seasons to evaluate and verify all identified sites. See Table 29 for the preliminary schedule according to activity.

Location

All data collection and fieldwork will be done within or just outside the Pea Patch Island Heronry Region in the birds' foraging areas in New Castle County and Salem County.

Costs and Funding

This strategy may require up to an estimated \$52,000 if significant flight time is required to conduct aerial surveys. Financing of this strategy is anticipated to come from government funding sources, federal, or

private grant programs. See Table 29 for costs and funding sources associated with each activity in this strategy.

Existing Programs

There are several existing programs that acquire land in Delaware, but the primary one is the Open Space Program, which has purchased thousands of acres of quality wetlands in the past five years. Other programs include the previously mentioned PSE&G Estuary Enhancement Program and the NJDEP Land Use Regulation Program, which protects wetlands in New Jersey.

Performance Measures

The acquisition or protection of additional foraging or nesting habitat for the PPI will be the performance measure of this strategy. It is possible that all key wetlands have already been identified.

Review/Key Decisions

Existing programs and authorities that will need to be encompassed in review and decision making are: Delaware Department of Natural Resources and Environmental Control, New Jersey Department of Environmental Protection, Manomet Center, PSE&G, and the US Fish & Wildlife Service.

TABLE 29

Strategy HI-5 -- Develop Specific Criteria for Heronry Requirements for Use in Land Acquisition and Protection

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Identify all key wetlands for PPI wading birds.	DNREC, NJDEP	USFWS, PSE&G, Manomet	20		✓				✓			22	0			USFWS, Fish and Wildlife Foundation
2. Identify all historic nesting habitat remaining in the PPIHR.	DNREC, NJDEP	USFWS, Manomet	2	✓								2	0			DCMP
3. Identify upland resources within the PPIHR that provide important foraging habitat for cattle egrets.	DNREC, NJDEP	USFWS, Manomet	20		✓				✓			18	0			DCMP
4. Identify and characterize wetlands for possible restoration and improvement in the PPIHR.	DNREC, NJDEP	USFWS, PSE&G	4	✓								4	0			DELEP, Fish and Wildlife Foundation
5. Develop specific ranking criteria for habitats identified and evaluate properties.	DNREC, NJDEP	Manomet	6			✓	✓			✓	✓	6	0			DPR
Total Person Weeks =				52								Total Cost Quarters 1-8 =		52		

HUMAN DISTURBANCE

Introduction

Pea Patch Island is a young island, first recorded during historic times as a mud bank emerging from the Delaware River in the late 1700's. Local folklore implies the partially submerged bar grounded a ship full of peas, giving the future island its name. As the river and tidal currents continued to deposit sediment at the site, the developing island's strategic value was immediately recognized by the military. Beginning in 1815, the first of several military installations located on Pea Patch Island protected the important American river ports to the north. Fort Delaware, as it later became known, was altered and improved numerous times over the succeeding decades effectively guarding the river approach to New Castle, Wilmington and Philadelphia for over one hundred years.

The island was tripled in size early this century when the U.S. Army Corps of Engineers (ACOE) and its contractors began a project to deepen the Delaware River channel from 28 feet to 40 feet. Beginning in 1901, the ACOE contractors added tons of dredged spoil from the new shipping channel to the original island, covering many historic features. When no more spoil could be added to the military installation, then dredged spoil was deposited around the north-western, western, and south-eastern edges of the historic island in 1902 and 1903, creating large marshes and a then insignificant upland area at the northern end of the island.

Erosion of the ACOE spoil deposit around the historic island began immediately following the deposition, but additional material was periodically added. Weise (1976) reported that the north end of the island was last used as a dump for gravel spoil in the 1930's. Except for a few small depressions, these gravel deposits supported little vegetation and remain virtually barren today. But the rings of soil that developed around the three low mounds of cobble and gravel did support vegetation. A few small trees are clearly visible in a 1932 aerial photo. Other photographs show a scattered but increased number of trees in 1945, which by 1961 had developed into a significant 30-year-old forest canopy.

It is believed that herons, egrets and ibises first began to use the isolated developing forest at the northern end of the island sometime during the early 1960's. D. A. Cutler reported 900 nesting pairs on the island in 1964. By the early 1970's the birds numbered an estimated 2,000 pairs. As more of the gregarious birds became attracted to the island, they abandoned mainland heronries in New Jersey and Delaware where presumably habitat destruction, human disturbance and natural predators drove them away. In 1974 through 1976, an estimated 7,500 pairs of birds were nesting on the island. At its peak in 1993, the population of Pea Patch birds numbered approximately 12,000 pairs of nine different breeding species of wading birds. Pea Patch had become the largest heronry on the Atlantic Coast north of Florida by far.

In 1951 Pea Patch Island, including Fort Delaware, was transferred to the State of Delaware as surplus property by the federal government prior to the establishment of the heronry. Although several acres near the Fort along the eastern edge of the historic island were 'perpetually eased' by the ACOE, the entire island became the responsibility of the State Division of Parks and Recreation (Parks). The main interest in the island was and largely remains the protection of historic Fort Delaware. But when the northern end of the island emerged as an active nesting site for long-legged waders a decade later, Parks actively managed the entire island to insure the protection of the heronry as well as the Fort. In the mid-1970's, when Parks

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

recognized that uncontrolled visitation to the island by well-meaning birdwatchers and other curious citizens would be detrimental to the birds, the heronry was declared off limits between April 15 and October 15 except by special permit. Three interpretive field trips limited to 15 people each were established to control access into the heronry. This allowed Parks to limit access to scheduled field trips and helped eliminate trespassing. In addition, the Youth Conservation Corps constructed two heronry observation towers on the historic part of the island across the marsh from the heronry.

Parks registered the heronry with the state's Natural Areas Program in 1982. In 1988, approximately 155 acres of the island was dedicated as the state's eighth nature preserve, the highest level of land protection available in the State of Delaware. The Pea Patch Island Nature Preserve included the entire upland that supported the heronry and the surrounding marsh. A management plan for the heronry was developed and approved by the Natural Areas Advisory Council (NAAC). This governor-appointed council of eight Delaware citizens advises the Secretary of the Department of Natural Resources and Environmental Control (as well as Parks) regarding issues affecting Delaware's Natural Areas and Nature Preserve programs. The management plan incorporated the three interpretive trips into the heronry that had been in effect for the previous 12 years. During this period the heronry expanded from 7,000 to 12,000 nesting pairs of birds.

There are still nine different heron, egret and ibis species nesting on the island. But in 1996 and 1997 the total number of nests dropped significantly to 7,000 and 6,000 pairs from the peak population numbers of 12,000 pairs just four years earlier. The drop in total numbers is due mainly to a decline in the numbers of three species: cattle egrets, snowy egrets, and little blue herons. It is feared that changing conditions over the wide area that the birds use to capture food for themselves and their young is contributing to their decline. The question is to what degree are human disturbance issues at the rookery contributing to the population decline?

Numerous studies throughout North America over the recent years have documented that colonial nesting birds are sensitive to a variety of human disturbances. In September 1997, the Delmarva Ornithological Society (DOS) and the Delaware Chapter of the Audubon Society (DAS) expressed their misgivings to Parks and the SAMP Core Group regarding the continued management policy of continuing the three interpretive tours into the heronry as well as some other potential human disturbance concerns. The SAMP Core Group authorized the development of a Human Disturbance Issue Characterization and Strategy Development for any identified human disturbance issues. Interested members of the SAMP contributed to this characterization.

Discussion

Existing issues

Interpretive Trips into the Heronry. The annual three interpretive trips that had been conducted into the Pea Patch Island heronry during the nesting season over the past twenty plus years were clearly the issue of greatest concern to DAS and DOS. For many years, the numerous people who participated in the trips considered this practice necessary, responsible, and appropriate. The reason the trips were begun in the first place was to address uncontrolled visitation to the island. The trips were believed to have been successful in providing a controlled environment to visit this significant and sensitive resource.

However the body of evidence collected nationally by researchers over the past two decades clearly indicates how detrimental this practice can be to nesting herons, egrets and ibis. Humans approaching a nesting colony on foot elicit a flight response in adult birds that then leave their nests, eggs, and or young nestlings unattended and vulnerable to high temperatures due to sun exposure, opportunistic predators, and even nest abandonment in extreme cases. It is clear that the birds are more frightened by pedestrians than even motorized vehicles such as boats.

Despite this annual disturbance, the heronry continued to expand during the two decades that the interpretive trips were offered, until 1994. Clearly the trips did not benefit the birds. However, the trips also should not be considered a major factor in the recent reduction of the birds' breeding population numbers on the island.

In October 1997, Parks suspended the interpretive tours into the heronry for 1998 to review the policy and explore other options. Parks also presented the concerns of DOS and DAS at a December 1997 meeting of the NAAC. The position of both organizations was to further protect the nesting birds, but not to eliminate opportunities to interpret this valuable site. At the December 1997 meeting, the NAAC recommended that the interpretive trips into the heronry be discontinued, and that an alternative approach to interpreting the heronry be found.

Control of Human Access to Pea Patch Island and to the Heronry. Uncontrolled access to the heronry was one of the motivating forces for the establishment of a Parks' management policy in the mid-1970's. At that time, Parks limited access to the heronry to three interpretive trips between April 15 and October 15 to eliminate trespassing. The stronger, more effective enforcement presence and reputation that Parks has established at Pea Patch Island has virtually eliminated trespassing as a problem. With the numerous Parks' staff and watercraft traveling to and from the island on a daily basis, it would be difficult to enter the heronry unseen today. In addition, Manomet research staff has served a dual role in monitoring human activity as well as birds in the heronry. They have had no encounters with unscheduled visitors to the heronry in the past four years of their work on the island. It is likely that a greater effort to monitor activities around the preserve will need to be made when Manomet biologists or other researchers are no longer present on such a regular basis.

Currently, access to the heronry is not accomplished casually. Visitors to the island arrive by the Delaware River and Bay Authority ferry (the DRBA took over the ferry operation of the same boat previously operated by Parks). The visitors are largely school groups and tourists who come to visit Fort Delaware and do not venture onto the loop trail. They do not have time to complete the historic tours *and* walk on the trail because the interpretive schedule at the fort is very tight and they could miss the return ferry. If someone were to walk the trail, braving mosquitoes and deerflies in summer, they would eventually find the remaining bird observation tower over 200 yards across a phragmites-dominated (*Phragmites australis*) marsh from the nearest nest. The distance across the marsh, even at low tide is a difficult, messy walk. The casual visitor will not and does not attempt it.

Manomet biologists access the heronry from the eastern side of the island, walking along the edge of the marsh and wading across the eroded 'inlet' that separates the heronry from the historic island. The trail they use is neither obvious nor possible without boots if you value keeping your feet dry or clean. The Delaware Division of Fish and Wildlife (F & W) which assists Parks with deer hunts on the island for the past few years knocks down a path through the phragmites to the heronry each winter with all-terrain vehicles. Because the first public visitors arrive at the Fort during the first weekends in April, the path across the marsh is still obvious for several weeks until the phragmites grows up in late May and June to hide it. For the few tourists who venture onto the trails, the path could serve as an invitation for some to walk toward the heronry, but the first few steps into the marsh discourages even the most adventurous. Someone who is going to Pea Patch with the intent of visiting the heronry is not likely to travel by the ferry, but by private boat. It is illegal to enter the Pea Patch Island Nature Preserve except by permit, and only researchers currently have permitted access. The nature preserve currently does not have enough signs, in the water or on land, to effectively delineate the boundaries of the protected area.

Deer Hunting. During the past few years, F & W has organized a permitted deer hunt on the island in cooperation with Parks. The hunt, conducted several days between October and January each year, does not

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

coincide with the breeding season of the herons. Although it is probable that a few great blue herons and black-crowned night herons use the heronry as winter roost during this period, there is limited contact between herons and hunters. The birds fly off the island to feed at dawn, returning to the island to spend the night. Hunting is conducted from stands located throughout the island, including the heronry.

Whitetail deer (*Odocoileus virginianus*) have been a significant problem on the island, eating the foliage off of young trees and shrubs as high as they can reach. Deer are excellent swimmers; they easily swam to the island across the river from New Jersey or Delaware. Once on the island, they over-populated the limited habitat, browsing on young trees and shrubs. When deer densities are high, these mammals can eliminate many species of plants. The density of deer on the island reached such extreme levels during the early 1990's that a controlled harvest removed over 70 deer from the island in one winter weekend. Most of the deer killed were extremely small compared to mainland animals. The present estimate of the deer herd on the island is around 20 animals, which is still considered too high. F&W estimates that the population for the island should be not be higher than three deer to reach the same level set for mainland deer herd densities. Efforts to control deer on the island through public hunting from deer stands are getting mixed reviews. Only one deer was harvested this past 1997 hunting season, while nine were taken the previous year. This may be allowing the deer numbers to increase on the island once again.

Research Disturbance to the Heronry. The goal of Parks' Pea Patch Island Nature Preserve, as well as the main focus of SAMP process, is to protect the Pea Patch Island heronry in perpetuity. Concerns about proposed power lines to be built across the Delaware River from New Jersey to Delaware initiated a research project funded by Delmarva Power and Light Company to study the effects of the construction and operation of 500 kV power lines on the herons nesting success. Jochen H. Wiese's study (1975-1978) of the heronry was the first major examination of the site. Mr. Wiese first noticed the use of the phragmites by some breeding birds, conducted population estimates over four years, and measured the loss of nesting substrate over a two year period, mainly in highbush blueberries (*Vaccinium corymbosum*).

From the late 1980's through the early 1990's the Non-Game Program of the Delaware Division of Fish and Wildlife conducted both ground and aerial surveys of the heronry to monitor the populations. These surveys were conducted over a one or two day period each year.

Dr. Katharine C. Parsons of the Manomet Center for Conservation Sciences (Manomet) assessed the population status and productivity of the heronry in 1993 at the request of Parks to guide future on-site management practices. Manomet conducted research funded by Parks and F&W. One of the cornerstone issues at the time was whether or not to spray the surrounding phragmites marsh as part of the statewide phragmites control effort. Dr. Parsons recommended against spraying the phragmites in the vicinity of the heronry because of the continued use of the phragmites as a nesting substrate by several species of herons and glossy ibis. Manomet's research effort at Pea Patch Island has continued up to the present time through the initiation of the SAMP process by the Division of Soil and Water in 1995. They are currently looking at issues ranging from the low productivity of several species of herons, the wading bird population trends in the region, and the pesticide and contaminant exposure of the birds, to the role that parasites and predators play in heron population dynamics.

To achieve the objectives of the research, Manomet biologists *must* enter the heronry on a regular basis to obtain the data necessary to answer these questions. Manomet staff is very concerned about the effect they have on the birds upon entering the heronry and while handling the eggs and chicks. Researcher disturbance is an issue that all biologists must be cognizant of so as not to color their research results. In recent years, numerous studies have been conducted to assess the effect on breeding success that various techniques of data collection have on a variety of colonial nesting bird species at all stages of their reproduction. Manomet is very interested in this issue and has contributed several studies to understanding researcher disturbance. To

obtain necessary data to achieve the long-term preservation of the mixed species nesting colony on Pea Patch Island, Manomet staff has used the latest body of knowledge regarding established research protocols that meet the test of doing the least harm possible. For example, biologists regularly visit only sub-areas within the heronry with just one or two researchers at a time to collect the needed data from as small a sample size as possible that can yield valid data.

Flights Over the Heronry. Pea Patch Island is not near any major flight lines, however unusual circumstances have put aircraft in direct conflict with the heronry on at least one occasion. During the media coverage of the oil spill of the Presidente Rivera on the Delaware River in the early 1990's, a television crew's helicopter landed on an open area near the heronry. To prevent an incident like this from happening again, the Delaware Governor's Chief of Staff called the FAA during the oil recovery operation. It is not clear if this established a temporary or permanent over-flight restriction. Current Parks policy prohibits the landing of aircraft within a park without a permit.

It has been observed that at least one individual who owns an amphibious aircraft regularly flies up and down the Delaware River corridor passing near the heronry. Other pilots may be following similar flight patterns as well. Although the kV 500 electric lines that cross the river 1.5 km to the north should prevent planes from flying too close to the surface near the heronry, this may not be true. Planes, especially flying low over a heronry, can cause significant disturbance to the birds and possibly endanger the aircraft occupants.

Muskrat Trapping. Muskrat (*Ondatra zibethica*) are common mammals on Pea Patch Island and throughout Delaware. Found in a variety of estuarine habitats, these semi-aquatic rodents are most successful in brackish marshes. They are found wherever they have a permanent slow-moving water source and a protected site for rearing young. Stable soils are particularly attractive and allow muskrats to dig burrows. In the case of Pea Patch Island, these soils were provided by the military in the form of a levee around the historic part of the island.

Although found in monotypic phragmites marshes, muskrats are found in much higher numbers in more diverse marshes. Damage to the levee and the causeway began to occur as the population of muskrats increased following the control of phragmites on the southern half of the island in 1994 (away from the heronry) and was subsequently naturally revegetated by native marsh plants. This area is also immediately adjacent to the historic fort and causeway to the boat dock, convenient for those muskrats that choose to burrow as opposed to the muskrats that build lodges. Muskrat population control is necessary to reduce damage to the historic levee. In high quality habitat, literally thousands of muskrats, each pair with a very small home range of just 7 to 30 meters, can occupy a high quality marsh.

The muskrat is one of the most valuable fur-bearing animals in North America. An estimated 30,000 animals are trapped in Delaware marshes each year. People also consume large numbers of the harvested animals. Trapping season begins when the muskrat's pelt is of the highest quality, with the onset of winter and ends about the time the earliest arriving herons, egrets, and ibis return to nest on the island. A proposal to trap muskrats on the southern half of the island in an area away from the heronry was not opposed by SAMP Core Group members last fall. This proposal was later approved at the NAAC quarterly meeting in September as a population control measure within the southern part of the Nature Preserve. Parks offered a bid for a permit to trap to interested parties and muskrat trapping began during the winter of 1997-98.

Oil Boom Location and Maintenance. Parks was contacted by the Delaware Bay and River Cooperative during the fall of 1995 to install four boom deployment points on Pea Patch Island. The locations of these boom points, two on each side of the island, were designed to protect the shoreline from oil traveling either upstream with the tide, or downstream. Three of the boom points were proposed inside the Nature Preserve.

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

The boom points consist of a large anchor post and a sign. The points were installed in the fall of 1996 after the birds had ceased nesting activities for the year. In the future, Parks has required that all maintenance of the boom points, two of which are near potential nesting areas, be completed during the October to mid-February temporal window when the nesting colony is not active.

Potential issues

Jet Skis in Proximity to the Heronry. Some concern has been expressed about the possible impact of jet skis around the heronry. These popular, noisy watercrafts are capable of great speed and can travel through very shallow water. They would be capable of approaching the heronry very closely. This has not been a problem at this point, but jet skis have been seen in the vicinity of Delaware City. Another reason for this concern is that one component of an older Parks' master plan for Fort DuPont contains a proposal for a marina. Although there are no plans to build the marina at this time, F & W and Parks are constructing a boat ramp on Parks' property at Fort DuPont. It is likely that this will increase boat and other small watercraft traffic on the river.

Predator Control in the Heronry. One issue that has come out of the Manomet research project is the possibility of predator control within the heronry. Although the idea has just been mentioned at this point, predation of eggs and young from nests is a major concern regarding the productivity of several species of herons, egrets and glossy ibis. Fish and common crows are the primary predators on the island, although raccoons, opossum, great horned owls, hawks, black-crowned night herons and possibly foxes have also been implicated. The major predators are crows who opportunistically wait for a chance to steal eggs and chicks. As many as 400 crows have been seen near the island at one time, but this is unusual. There are regularly several dozen crows feeding off of the heronry. Many actually nest on the island in the midst of herons that provide their sustenance.

Before recommending control of these predators, the situation on the island would have to be dire indeed. The difficulty of controlling crows through baited traps or other means while limiting the disturbance to the nesting herons would be challenging. Control of raccoons would necessitate the entry into the heronry on a daily basis to check traps. A predator control effort would have to be carefully designed and considered absolutely necessary before it was implemented.

Erosion Stabilization Plans for the Island. Ever since Pea Patch Island was first enlarged by the ACOE in 1901-03, the spoil deposits have been slowly eroding, especially on the eastern and southern portions of the island nearest the shipping channel. Acres of spoil sediment that had supported marsh have since disappeared from the southern end of the island exposing the levee surrounding Fort Delaware to the river's flow and incoming tides. A storm in 1962 breached the historic levee and sediments containing historic material began washing into the river, a process that still continues. In 1996, Parks contracted with a marine engineering firm to design a seawall that could protect the fort and the levee from further erosion. This design was to consider the erosion around the entire eastern side of the island, including the area near the heronry where a 'cove' has formed between the historic island and the created upland where the heronry is located. It appears that if nothing is done, eventually the island may be cut in half at this site, separating the heronry from the historic island. The consultants began surveying the shoreline to determine erosion rates and possible solutions during the summer of 1997. They delayed their survey near the heronry until after the birds departed at the request of Parks. Any proposed solution to the erosion problem, which currently remains unfunded, will focus first on the historic portion of the island where the greater erosion is obvious. But the long-term goal of erosion stabilization encompasses the entire eastern shoreline, including the heronry.

Channel Deepening Project Proposed by the U.S. Army Corps of Engineers. The main Delaware River channel has never had to be dredged near the island to deepen the channel, although occasional maintenance dredging to

remove submerged bars or sediment slumping from the channel sides is necessary. The velocity of the river generally maintains a channel deeper than is necessary adjacent to the island even for the proposed future river traffic in this area. The proposed 45-foot deep channel that the ACOE is currently promoting would not require any channel deepening immediately next to the island. There is not a proposal to add spoil to the island at this time. The Coastal Zone Management Program's federal consistency review process requires that any maintenance dredging to be done near Pea Patch Island be completed between September and the following April to avoid the nesting period of the herons.

Increased Development of Fort Delaware Attracting More Tourists to the Island. The planned reconstruction of historic facilities on the island also has been of some concern to DOS. In addition, concerns have been expressed about the numbers of tourists projected to visit the island in the future.

Interpreting Fort Delaware and its nearly two centuries of existence to park visitors is an important mission and obligation of Parks as a state public recreation organization. A contracted master plan produced for Parks in 1996 for the restoration of historic Fort Delaware was not sensitive to some issues surrounding the heronry. The plan has been reevaluated from fiscal, interpretive, environmental, and operational perspectives; including heronry issues. A scaled-back version of the plan has resulted, including a significant buffer from the heronry. The historic island is already separated from the heronry by 200 yards of marsh. Ongoing historic restoration of the southern portion of the civil war era prison facility is three times that far from the heronry.

Fort Delaware currently attracts between 20 and 30 thousand visitors per year. In 1997, the Delaware River and Bay Authority (DRBA) operated the ferry service between Fort DuPont in Delaware, Pea Patch Island, and Fort Mott in New Jersey. Projections of 50,000 visitors to the island per year or more are possible in the next decade.

Noise Disturbance. There are few known noise disturbance problems within the heronry at the present time. Fort Delaware's cannons are fired only at three special times throughout the year, such as part of the Delaware City Days in June each year. Fireworks are also part of the celebration. Muskets are fired on a more regular basis inside the Fort as part of interpretive programs. In fact, this is a standard type of interpretive program at all similar facilities throughout the country. The affects on the birds at Pea Patch Island are unknown. Parks has acquired one of the many cannons that were once used at the fort for an interpretive display. The intent is to fire the cannon once a day as part of the interpretive program. However, this is not intended to be the main focus of the interpretive activities at the Fort. The stories of the people who lived at Fort Delaware are considered the central point of the interpretive story to be told; not their weapons.

During the 1997 research season, a Manomet biologist reported hearing a distant unknown explosion occurring around 3 PM on a regular basis. The nestlings flinched at the sound of the explosion but did not leave their nests. The main response of the birds to the explosion appeared to be some nervous vocalizations from the adults and chicks. The source of the explosion had been assumed to be Fort Delaware, but it was not.

Exotic Plant Species Control in the Heronry. The vegetation of the heronry is decidedly native in origin. The percentage of exotic species is low. However, some exotic tree species have become established in the heronry. One species in particular, the Tree of Heaven (*Ailanthus altissima*) is capable of replacing native trees as they succumb to the changes in soil chemistry that the herons produce. Ailanthus has a very open spreading character and is extremely tolerant of a wide variety of soil conditions. It does not have a similar structure to the native tree species that the herons use as nesting substrate. They could ultimately reduce the available nesting habitat within the heronry if they increase in numbers. The timing of a control project

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

would be important to effectively control the targeted exotic species while not disturbing nesting birds.

Recommended Strategies

There has been one comprehensive strategy designed to address the issues raised here in this characterization.

HU-1 Managing Human Disturbance Within Pea Patch Island Heronry.

Strategy HU-1 Managing Human Disturbance within Pea Patch Island Heronry

Activities:

- Develop alternative interpretive options to field trips into the heronry.
- Study effects of loud noises on the heronry and establish noise management policies.
- Increase the visibility of signage surrounding the nature preserve, including signs in the water near the heronry.
- Maintain research protocol and monitor research activities at the heronry.
- Confine management activities in the nature preserve to non-breeding season whenever possible.
- Maintain a vegetative buffer between Fort Delaware and the heronry.
- Establish a photographic and media protocol for the heronry.
- Recommend restrictions for overflights of the heronry.

Participating Institutions:

- **Delaware Department of Natural Resources & Environmental Control**
 - Division of Parks and Recreation
 - Division of Fish and Wildlife
 - Division of Soil and Water Conservation
- Manomet Center for Conservation Sciences
- United States Fish and Wildlife Service, Delaware Bay Estuary Project
- United States Army Corps of Engineers

Schedule: 1 to 3 years for the various components of this strategy.

Cost: \$120,000 - 320,000

Managing human disturbance issues at the Pea Patch Island heronry has been and remains an integral part of the Division of Parks and Recreation's overall management responsibilities on the island. Most of the components of the following activities are already partially or fully in place to deal with those responsibilities. Other components, such as the proposed interpretive activities below, are completely new ideas in step by a new era of preservation, restoration and interpretation at Fort Delaware. Implementation of some of these strategies has already begun while others may be years and several hundred thousand dollars away.

Primary Activities

Activity 1. Develop alternative interpretive options to field trips into the heronry. The brick, non-civil war era building near Fort Delaware on the historic portion of the island has been designated as the future home of an interpretive nature center. Space in the Pea Patch Island Nature Center will be dedicated to displays and information about the heronry, the Delaware River and other cultural and ecological issues will be available. Sources of funding for this project likely would involve a public-private partnership. The possible ideas or combination of ideas, for interpreting the heronry includes:

**Pea Patch Island Heronry Region
Special Area Management Plan
July 1998**

- 1) Establish a “virtual heronry” in the nature center by placing tiny remote cameras carefully positioned near nests before the arrival of the herons each spring. The live visuals of the birds’ reproductive activities, from eggs to fledglings, during the course of the nesting season would be accessible to remote viewers in the nature center. A total of \$30,000 is a very rough estimate of the cost to set up a presentation of this nature. One remote camera setup would cost around \$10,000. Because of the distance involved, the cost could be much higher.
- 2) Establish a resource collection of slides and photographs of the bird species found at Pea Patch Island for use in presentations and displays. This acquired or contracted photographic collection would document the life cycle of each species. Examples of photographs for each species would include developmental photographs from egg to adult, nests, intra- and inter-specific behavior, foraging behavior, prey species, and predators. This resource collection will cost approximately \$5,000.
- 3) These photographs could be used in a virtual reality computer program, combining the photographs with video footage to construct an interactive software program. This educational tool would be available for use in elementary and secondary school science curriculums, and through a web-site, as well as at the nature center. An interactive computer program could cost anywhere from \$50,000 to 250,000 depending upon the complexity of the software.
- 4) Videos about the heronry could be shown on the boat trip to the fort from Delaware City. For many visitors, this might be the first time they have heard about the heronry.
- 5) Mount quality telescopes on the existing observation tower or a newly constructed blind across from the heronry. Telescopes would add greatly to the experience along the interpretive trail. A blind could shelter visitors from the sun, rain and insects while providing an excellent controlled platform to view the heronry from across the marsh. Examine other possible locations for the blind.
- 6) Examine the feasibility of scheduled boat tours of the heronry and the river. The difficulties in approaching the heronry near the island, channel depth, time constraints, and disturbance issue with the herons all make this option appear remote.

Activity 2. Study effects of loud noises on the heronry and establish noise management policies. The Division of Parks and Recreation (Parks) recently acquired a large cannon known as a Rodman Gun for display along with five Columbiad Cannons at Fort Delaware. Parks proposes to fire a blank charge from the Rodman Gun once a day when the Fort is open to the public. This demonstration is to be an integral part of the historical interpretation program of Fort Delaware’s 19th century weaponry. The fort opens the last weekend of April through September each year, which roughly coincides with the nesting period of the herons. The effect on the birds of the loud noises created by fireworks or cannon fire is not known, but remains a concern. The fort currently fires a smaller cannon on three special occasions throughout the year. This study would determine whether firing the cannon poses a disturbance threat to the birds or not. The birds’ reactions will be monitored through telescopes as well as video for responses to the noise associated with these explosions. The study will be coordinated between Parks, Manomet research staff, and other observers.

Unidentified explosions not associated with the fort have previously been heard in the heronry by Manomet research staff. The noise generated by these explosions made nestlings flinch and adults vocalize before quickly settling down after a few seconds. The disturbance caused by these explosions was considered minor.

Activity 3. Increase the visibility of signage surrounding the nature preserve, including signs in the water near the heronry. Boundary signs have previously been posted by Parks around the Pea Patch Island Nature Preserve. Some of the signs are missing or need to be replaced. The entire perimeter of the heronry would be posted beyond the minimum disturbance distance for Great Blue Herons, the least tolerate species of disturbance on the island.

To accomplish this along the perimeter of the heronry, some signs would need to be posted on pilings in the water. The signs would be: large enough to read from a distance; be approved by the US Coast Guard and any other affected agency; and declare the “area is closed to the public”. Signs posted near the nature trail on the historic island would be smaller. The deer hunting path to the heronry through the phragmites created each winter would be posted where it leaves the historic island.

In addition, signs would be posted at nearby marinas warning boaters and jet skiers of the “area closed to the public” zone around Pea Patch Island, including any applicable fines involved with breaking this restriction. In addition, this information could be distributed to boat owners during the permitting process to protect this and other breeding areas around the state as well (i.e., Middle Island in Rehoboth Bay).

Activity 4. Maintain research protocol and monitor research activities at the heronry. Ensure that any proposed research at the Pea Patch Island Heronry is consistent with Parks nature preserve goals of protecting the heronry. All research proposals must be approved by the Division of Parks and Recreation.

Research proposed in the heronry has been reviewed and modified the last two years by a SAMP Research & Biomonitoring Group composed of management (Parks, Soil and Water, Fish and Wildlife) and research (Manomet, USF&W, University of Delaware) staff familiar with the site and/or the proposed research. Additional research within the heronry is planned for at least the next two field seasons (summers of 1998 and 1999). The goal of having approximately 10 years of research data has also been proposed at previous SAMP Research & Biomonitoring Group meetings. In addition, species specific population estimates based upon a consistent protocol will be necessary every year from this point forward. An annual review of proposed research will continue.

Activity 5. Confine management activities within the nature preserve management to non-breeding season whenever possible. Many management activities within the Pea Patch Island Nature Preserve must be undertaken during the non-breeding season. These activities include any deer management actions, muskrat trapping, plant surveys, predator control, and exotic plant species control and management. Scheduled projects of other agencies, such as erosion control, channel maintenance dredging, and oil boom deployment drills must be scheduled during the non-breeding season within the vicinity of the island. Emergency activities that must be undertaken during breeding season should be accomplished as quickly and sensitively as possible.

Activity 6. Maintain vegetative buffer between Fort Delaware and the heronry. Maintain a visual screen between the heronry and the historic island. This buffer of trees and shrubs protects the heronry from the human activities and sounds at Fort Delaware on the historic part of Pea Patch Island. Exotic plant species within this buffer should be replaced by native species.

Activity 7. Establish a photographic and media protocol for the heronry. There has been an increase in requests for access to the heronry by various photographic, print and video media. Parks will establish a media protocol for media access to the island. Any decision on whether access is granted or not depends on the level of disturbance involved. Access to the heronry should be limited to a certain amount per year and these trips should not be done without a guide designated by Parks.

The possibility of permanently establishing a photographic blind will be examined as this may cause the least amount of disturbance while still providing a non-mobile accessibility to the heronry. A blind might also allow an elevated research platform to observe the heron species that currently nest out of reach of the researchers. A blind might also serve as a location to feed live visuals and audio to the nature center.

Activity 8. Establish restrictions for overflights of the heronry. A protocol should be developed for flights over and to the island. Parks currently restricts any landing on any park property without the written approval of the director. Parks has gotten such approval for the media to land on the island. However, we have set a precedent that the only approaches and landings are to be made from the southern tip of the island. The National Guard

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

and military do occasionally perform practice flights over the island. This is something that may be worthwhile to investigate and or prohibit if possible. Parks will request FAA support to restrict the airspace above the heronry. Note that phragmites spraying occurs only in non-breeding season and not around the heronry.

Implementation

Institutional Responsibilities

The primary lead for implementation in Delaware will be DNREC's Division of Parks and Recreation, with support from the Divisions of Soil and Water and Fish and Wildlife, Manomet Center for Conservation Sciences

Schedule

The activities will take an estimated 1 to 2 years to complete.

Existing programs

With the exception of Activity #2, all the other activities have already been initiated by Parks at some level. Most activities involve refining an existing activity.

Location

All activities are located on Pea Patch Island.

Costs and Funding

This strategy will involve staff time and additional funding to accomplish. Some of the activities may prove to be attractive to private funding. In general, the activities are anticipated to come from DNREC general funds, or from private/public grants.

Performance Measures

Performance measures include 1) the achievement of new interpretive options; and, 2) the protection of the heronry from human disturbance except those activities that directly benefit the heronry.

Review/Key Decisions

Existing programs and authorities that would need to be encompassed in review and decision making for the strategy: Delaware Department of Natural Resources and Environmental Control, USFWS, Delaware Bay Estuary Project.

TABLE 30**HU-1 -- Managing Human Disturbance within the Pea Patch Island Heronry**

				Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
Primary Activity	Proposed Lead	Primary Support	Person Weeks	1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Develop alternative interpretive options to field trips into the heronry.	DPR	DNREC	8	✓	✓	✓	✓	✓	✓	✓	✓	5	300	✓	✓	DPR Industry Private DNREC
2. Study effects of loud noises on the heronry and establish noise management policies.	DPR	Manomet DOS DNREC	10	✓	✓							3	0	✓		DNREC
3. Increase the visibility of signage surrounding the nature preserve, including signs in the water near the heronry.	DPR	USCG DNREC	6					✓	✓			10	0		✓	DNREC
4. Maintain research protocol and monitor research activities at the heronry.	DPR	DNREC USFWS Manomet	5	✓	✓	✓	✓					1	0	✓		DPR
5. Confine management activities within the nature preserve to non-breeding season whenever possible.	DPR	DNREC	5	✓	✓							0	0	✓		DPR
6. Mainatin vegetative buffer between Fort Delaware and the heronry.	DPR	DPR	3				✓	✓				0	0	✓		DPR DFW
7. Establish a photographic and media protocol for the heronry.	DPR	DPR	3	✓	✓							0	0	✓		DPR
8. Establish restrictions for overflights of the heronry.	DPR	DRBA FAA	3	✓	✓							0	0	✓		DPR
Total Person Weeks = 43				Total Cost Quarters 1-8 = 19												

OUTREACH & EDUCATION Strategy OE-1 Communication/Outreach That Creates a Greater Awareness of the Heronry and its Importance for the General Public and Targeted Audiences

Activities:

- Assessment.
- Identification.
- Planning and enrollment.
- Development of specific outreach products.
- Monitoring and measurement.
- Continue enrollment/networking activities.

Participating Institutions:

- Delaware Department of Natural Resources & Environmental Control
- New Jersey Department of Environmental Protection
- Pennsylvania Department of Environmental Protection
- Tri-State Bird Rescue
- U.S. Coast Guard
- Army Corps of Engineers
- Environmental Protection Agency
- Fish & Wildlife Service - Delaware Bay Estuary Program
- National Marine Fisheries Service
- National Oceanic & Atmospheric Administration
- Delaware River Basin Commission
- Port Authorities
- Local government agencies
- Educational institutions
- Private Industries

Schedule: Work can begin as soon as funding is obtained. Activities 1-4 will be completed within two years of implementation. Activities 5-6 will become on-going for re-evaluations and modifications towards the development of a 5 year communications plan.

Cost: \$160,000.

The goal of this strategy is to develop a multi-phased communication and education outreach effort that creates a greater awareness and understanding of the heronry and its importance for the general public and

**Pea Patch Island Heronry Region
Special Area Management Plan
July 1998**

targeted audiences. This strategy will require the formation of a communications and outreach team, which will develop and oversee a 5 year communications plan for the SAMP.

Once formed, the team will work with various SAMP partners to develop specific communication tools designed for both general and specific audiences, serve as a networking resource for shared materials and information, and provide coaching/training in the use of the produced outreach materials.

The team's strategies will integrate into existing outreach initiatives of both States, Federal Agencies, and NGOs, and support the various scientific, policy, regulatory, and protection strategies of the SAMP.

The communications plan will include suggested uses of appropriate media as needed, including print, video, CD-ROM, Internet, as well as formal and informal outreach presentations. The development of each communication product will be conducted in partnership with the appropriate SAMP partners, and will include the training (as needed) of various SAMP partners in the use of both the general and specific outreach tools.

Primary Activities

The following activities are presented given the following assumptions:

- The overall plan will be developed in a modular manner, allowing for flexibility in approach, funding, and execution.
- All educational and outreach tools will be developed through consideration of cost-benefit analysis.
- All materials will be designed to build upon previous outreach efforts, and considered for possible re-use in other SAMP outreach efforts.
- All materials will be indexed and stored in a manner that they can be easily accessed by SAMP partners and for other outreach efforts.

Activity 1. Assessment. Assess and record the present state of the environmental and education outreach programs currently in place, noting if there is a Pea Patch Island Heronry component. This assessment should be done in conjunction with all government (local, state, federal), environmental, educational, and business outreach initiatives, noting their emphasis and demographic distribution. The assessment should also include an analysis of each organization's receptivity (guidelines) for partnering the development of education materials.

Activity 2. Identification. Identify key audiences and specific message points to be delivered. For "hard-to-reach" audiences, analyze how they prefer to receive their information, and design an outreach communications component accordingly (i.e. informal meetings with landowners). Identify distribution/networking outreach possibilities outside those already committed to working on educational and environmental issues. Specifically, analyze such non-traditional distribution networks as broadcast television, the Internet, corporate newspapers and video information programs that might provide additional outreach.

Activity 3. Planning and Enrollment. Develop a 5 year communications/outreach strategy and timeline that is comprehensive and inclusive, and that uses each outreach effort (and the materials gathered for it) to contribute to and help build the next. This plan will be designed in a modular manner, and be based upon:

1. Enrolling as many groups as possible with educational outreach initiatives into the effort, and coaching/training them about how to integrate the new outreach materials created or adapted into their programs.
2. Building a funding network designed to leverage multiple funding sources (private, local, state, federal, foundation) to underwrite specific outreach tools.

3. Working with the existing educational outreach programs already in place, supplying them with either adaptive outreach materials or new materials.
4. Training appropriate SAMP partners in basic listening, conflict-resolution, and consensus-building skills, which will be occasionally needed when working in initial outreach meetings and potentially contentious groups.

Activity 4. Development of Specific Outreach Products. Develop specific communication and outreach tools that support the communication/outreach needs of specific SAMP strategies, and general SAMP awareness efforts. This step will include:

1. Understanding specific SAMP strategies and the targeted audience for the communication.
2. Assessing the best way to reach targeted audiences, and designing the appropriate communications/outreach tools.
3. Working with the appropriate outreach coordinators (of SAMP partners) to prepare them for work with specific audiences.
4. Providing additional support and coaching for the coordinator through the SAMP network of educators.

Develop educational outreach tools based upon:

1. Designing a “Chinese menu” of outreach materials, all of which rely upon the same basic information and “raw materials”.
2. Conducting a cost/benefit analysis for each tool based upon its ability to “build off” of other outreach tools, re-purposing already-gathered raw materials, current budget constraints, distribution potential, and the immediate need for audience-specific communication.
3. Developing and indexing a communications and source material database which will be used for future SAMP communications and be made available to other groups interested in promoting and protecting the resource.

Activity 5. Monitoring and Measurement. Measure the effectiveness of each communication/outreach effort and periodically review the overall communications plan. Maintain on-going communication and information updates between the various groups involved in the SAMP process. This activity will include:

1. Designing effective measurement and feedback tools/methodologies to monitor the effectiveness of each communication effort.
2. Using these measurement tools to monitor communication effectiveness.
3. Establishing a periodic review process and timetable of the overall communications plan.
4. Providing periodic updates to all SAMP participants on the newly published outreach tools, as well as updates on the SAMP implementation.
5. Serving as a central point for information sharing about the outreach efforts of each SAMP member.
6. Continuing to produce communications directed at recruiting additional “member” into the SAMP implementation process.

Activity 6. Continued Enrollment/Networking Activities. Explore and suggest new opportunities to present SAMP outreach efforts. This activity will include:

1. Exploring new ways in which the SAMP outreach message can be incorporated into other “environmental” initiatives.
2. Recruiting new partners into the SAMP implementation process.
3. Working with SAMP partners to suggest and plan innovative outreach opportunities that might not already exist (i.e. kiosks at Fort Delaware, environmental lesson plans presented over the Internet to schools).
4. Leveraging various types of SAMP “partner” funding with private/corporate underwriters interested in contributing to specific SAMP outreach efforts.

5. Maintaining a strong relationship with existing media (print, television, etc.) to insure that SAMP outreach messages are well understood by the general public, business, and government officials.

Implementation

Institutional Responsibilities

The broad communication and outreach needs of the SAMP and its constituents require a high degree of internal communication and coordination. This can only be accomplished if there is a central point of contact, which all the SAMP partners can use as a communication resource.

Logically, this point of contact should be tied to the SAMP Implementation Team and the DCMP. Therefore, it seems appropriate that the SAMP outreach offices operate as part of that body. Working closely with the DCMP, the outreach team will be able to closely monitor the implementation process, and the progress of each strategy.

However, since the scope of the SAMP implementation will require multiple communications and multiple audiences, many SAMP partners and outside agencies will be contributing as well. This includes, but is not limited to local, state, and federal government agencies, environmental groups or organizations, school districts and even businesses. Depending on which communication tools are chosen to be developed, this effort might involve broadcast and cable television stations and distributors of educational software products.

Finally, academic institutions (i.e. colleges) involved in providing training for environmental education might be used to help disseminate these materials.

Schedule

Work can begin on development and implementation as soon as possible. The estimated time for completing this strategy from start to finish is 2 years with additional time for on-going activities. See Table 31 for the preliminary schedule according to activity.

Location

This strategy will focus on public areas in Delaware, southern New Jersey and Pennsylvania primarily located within the Pea Patch Island Heronry Region.

Costs and Funding

The anticipated annual costs for implementation will be \$60,000 to \$100,000. See Table 31 for costs associated with each activity. This budget should be understood to be "seed" money for the initial outreach effort. The key here is to leverage whatever money is budgeted for the purpose of building a stronger funding base. This would include pursuing matching grants, private funding, and corporate support.

The ultimate goal is to develop a process based upon sharing costs amongst SAMP participants conducting outreach activities, leveraging those dollars to secure additional moneys which will fund a broadened outreach initiative.

Performance Measures

The outreach team will be measured by its ability to effectively design, fund, and produce communication and outreach materials for the SAMP. Each outreach initiative will be measured for its individual effectiveness, as well as its effectiveness within the overall communications plan.

The outreach team will periodically review the overall communications plan to monitor its success in achieving the plan's broader communication objectives, and the criteria defined within the plan.

Review/Key Decisions

The performance of the SAMP outreach effort will be reviewed annually by the SAMP Implementation Team.

TABLE 31

Strategy OE-1 -- Communication/Outreach that Creates a Greater Awareness of the Heronry and Its Importance for the General Public and Targeted Audiences

Primary Activity	Proposed Lead	Primary Support	Person Weeks	Implementation Schedule								Estimated Implementation Costs		Funding		
				Quarter (in 3 month increments)								Thousands of Dollars		Means		Source(s)
				1	2	3	4	5	6	7	8	Cost Quarters 1-8	Subsequent Costs	Existing	Potential	Institution
1. Assessment.	DNREC, NJDEP	PADEP, Tri-State, EPA, DRBC	4	✓	✓							8			✓	DNREC, EPA, USFWS, private foundations
2. Identification.	DNREC, NJDEP	PADEP, Tri-State, EPA, DRBC	4		✓							8			✓	DNREC, EPA, USFWS, private foundations
3. Planning and enrollment.	DNREC, NJDEP	PADEP, Tri-State, EPA, DRBC	20		✓	✓	✓	✓	✓			60	30/yr		✓	DNREC, EPA, USFWS, private foundations
4. Development of specific outreach products.	DNREC, NJDEP	PADEP, Tri-State, EPA, DRBC	20				✓	✓	✓			60	30/yr		✓	DNREC, EPA, USFWS, private foundations
5. Monitoring and measurement.	DNREC, NJDEP	PADEP, Tri-State, EPA, DRBC	12							✓	✓	16	10/yr		✓	DNREC, EPA, USFWS, private foundations
6. Continued enrollment/Networking activities.	DNREC, NJDEP	PADEP, Tri-State, EPA, DRBC	12					✓	✓	✓	✓	16	10/yr		✓	DNREC, DPI, EPA, USFWS, private foundations
Total Person Weeks =				72								Total Cost Quarters 1-8 =		160,000		

REFERENCES

- ADL. 1994. Distributions of chemical contaminants and acute toxicity in Delaware Estuary sediments. Final Report submitted Delaware Estuary Program.
- Ashton, F.M. and T.J. Monaco, 1991. Weed Science - Principals and practices, Third edition. John Wiley & Sons, Inc. New York, NY
- Beyer, W. N., G. H. Heinz, and A.W. Redmon-Norwood 1996. Environmental Contaminants in Wildlife: Interpreting Tissue Concentrations. Lewes Publishers, Boca Raton, Florida.
- Blodget, B. G. 1985. The Census Man Cometh--for seagulls and sundry other fowl of the sea and shore. Bird Observer of Eastern Mass 13: 126-134.
- Budavaki, S. (Editor), 1996. The Merck Index, 12th edition, Merck Research Laboratories Division of Merck & Co. Inc. Whitehouse Station, NJ
- Butler, R. W. 1992. Great Blue Heron. *In* The Birds of North America, No. 25 (A. Poole, P. Stettenheim, and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, DC: The American Ornithologists' Union.
- Carlson, B.A. and E.B. McLean. 1996. Buffer zones and disturbance types as predictors of fledging success in great blue herons, *Ardea herodias*. Colonial Waterbirds 19(1): 124-127.
- Carter, D. 1992. The Thousand Acre Marsh. Report submitted DE Dept. Natural Resources and Environmental Control.
- Clark, K. E., L. J. Niles, and J. Burger. 1993. Abundance and distribution of migrant shorebirds in Delaware Bay. Condor 95: 694-705.
- Coastal Zone Management Act of 1972. 16 U.S.C.A. § 1451 - 1464.
- Costa, J. H., T. C. Sauer 1994. Final Report: Distributions of Chemical Contaminants and Acute Toxicity in Delaware Estuary Sediments. Arthur D. Little, Inc., Cambridge, Massachusetts.
- Custer, T. W. and H. M. Ohlendorf. 1989. Brain cholinesterase activity of nestling Great Egrets, Snowy Egrets and Black-crowned Night-Herons. J. Wildl. Dis. 25: 359-363.
- Custer, T. W., C. M. Bunck, and T. E. Kaiser. 1983. Organochlorine residues in Atlantic coast Black-crowned Night-Heron eggs, 1979. Colonial Waterbirds 6: 160-167.
- Custer, T. W. and R. G. Osborn. 1977. Wading birds as biological indicators: 1975 Colony Survey. U.S. Fish & Wildlife Service, Spec. Sci. Rep. Wildl. No. 206. 28 pp
- Davis, W. E. and K. C. Parsons. 1991. Effects of investigator disturbance on the survival of Snowy Egret nestlings. J. Field Ornithol. 62: 432-435.

Pea Patch Island Heronry Region
Special Area Management Plan
July 1998

Delaware Department of Natural Resources & Environmental Control. 1985. Pea Patch Island Heronry Study: Preliminary Results. Delaware Dept Natural Resources and Environmental Control. 25pp.

Delaware Department of Natural Resources and Environmental Control. 1996. State of Delaware Watershed Assessment Report (305(b)).

DeMauro, M. M. 1993. Colonial nesting bird responses to visitor use at Lake Renwick heron rookery, Illinois. *Natural Areas Journal* 13(1): 4-9.

Downer, R. H. and C. E. Liebelt. 1990. 1989 Long Island Colonial Waterbird and Piping Plover Survey. NYS DEC Res Rep. 200p.

Eisler, R. 1985. Cadmium Hazards To Fish, Wildlife, and Invertebrates: A Synoptic Review. U.S. Fish Wildl. Serv. Biol. Rep. 85 (1.2).

Eisler, R. 1990. Chlordane Hazards To Fish, Wildlife, and Invertebrates: A Synoptic Review. U.S. Fish Wildl. Serv. Biol. Rep. 85 (1.21).

Eisler, R. 1986. Diazinon Hazards to Fish, Wildlife, and Invertebrates: a Synoptic Review. U.S. Fish and Wildlife Service. Contaminant Hazard Reviews, Report No. 9. Patuxent, MD. 37 pp.

Eisler, R. 1988. Lead Hazards To Fish, Wildlife, and Invertebrates: A Synoptic Review. U.S. Fish Wildl. Serv. Biol. Rep. 85 (1.14).

Eisler, R. 198. Mercury Hazards To Fish, Wildlife, and Invertebrates: A Synoptic Review. U.S. Fish Wildl. Serv. Biol. Rep. 85 (1.10).

Eisler, R. 1987. Polychlorinated Biphenyl Hazards To Fish, Wildlife, and Invertebrates: A Synoptic Review. U.S. Fish Wildl. Serv. Biol. Rep. 85 (1.7).

Ehrlick, P.R., D.S. Dobkin, D. Wheye. 1988. *The Birders Handbook*. Simon & Schuster, Inc. New York NY, 785 pp.

Epstein, M.B. and R.L. Joiner, 1986. "Use of Managed and Open Tidal Marsh by Water Birds and Alligators". Chapter 15, pp. 529-579. *in* M.R. DeVoe and D.S. Baughman. 1986. "South Carolina Wetland Impoundments: Ecological Characteristics, Management, Status, and Use". Vol. 2: Technical synthesis. Technical Report #SC-SG-TR-86-2. South Carolina Sea Grant Consortium, Charleston, S.C. 611pp.

Epstein, M.B. and R.L. Joiner, 1987. "Use of Managed and Open Tidal Marsh by Water Birds and Alligators: Project Prospectus". *in* Whitman, W.R. and W.H. Meredith, eds., 1987. *Waterfowl and Wetlands Symposium: Proceedings of a Symposium on Waterfowl and Wetland Management in the Coastal Zone of the Atlantic Glyway*. Delaware Coastal Management Program, Delaware Department of Natural Resources & Environmental Control, Dover, Delaware. 522 pp., pps. 46-49.

Erwin, R. M. and C. E. Korschgen. 1979. Coastal waterbird colonies: Maine to Virginia, 1977. USFWS, Biol Servs Prog, FWS/OBS-79/08.

Estuary Enhancement Program. Public Service Electric and Gas Company. New Jersey.

- Extension Toxicology Network (Exttoxnet) 1996. A Pesticide Information Project of Cooperative Extension Offices of Cornell University, Michigan State University, Oregon State University and University of California at Davis.
- Fox, G. A. 1992. Epidemiological and pathobiological evidence of contaminant-induced alterations in sexual development in free-living wildlife. Pp. 147-158 *in* Chemically-induced alterations in sexual and functional development: The wildlife/human connection (T. Colborn and C. Clement, eds.). Vol XXI. Advances in Modern Environmental Toxicology. Princeton Scientific Publ. Co., New Jersey.
- Frederick, P. C. and M. W. Collopy. 1989. Researcher disturbance in colonies of wading birds: effects of frequency of visit and egg-marking on reproductive parameters. Colonial Waterbirds 12(2): 152-157.
- Gianessi, L.P. and Anderson, J.E. 1995. 'Pesticide Use in Delaware Crop Production' National Center for food and Agricultural Policy, Washington.
- Gochfeld, M. 1980. Mechanisms and adaptive value of reproductive synchrony in colonial seabirds. *In* Behavior of Marine Animals: Vol. 4 Marine Birds (J. Burger, B. Olla, and H. Winn, Eds.). Plenum Press, New York.
- Grue, C. E., W. J. Fleming, D. G. Busby, and E. F. Hill. 1983. Assessing hazards of organophosphate pesticides to wildlife. Trans. N. A. Wildl. Nat. Res. Conf. 48: 200-220.
- Hamilton, G.C. and Meyer, R.M. 1992. Agricultural Pesticide Use in New Jersey, A survey of Private Applicators in 1985 and 1988. NJDEP Pesticide Control Program and Rutgers Cooperative Extension.
- Hamilton, P. A. and R.J. Shedlock. 1992. Are Fertilizers and pesticides in the Ground Water? A Case Study of the Delmarva Peninsula, Delaware, Maryland, and Virginia. U.S. Geological Survey Circular 1080. 16 pp. 90 pp.
- Hill, E.F., and M.B. Camardese. 1986. Lethal Dietary Toxicities of Environmental Contaminants and Pesticides to Coturnix. U.S. Fish & Wildlife Service, Fish Wildl. Tech. Rep. 2, 147 pp.
- Hill, E. F. 1995. Organophosphorus and carbamate pesticides. *In* Handbook of Ecotoxicology (D.J. Hoffman, B. A. Rattners, G. A. Burton, and J. Cairns, eds.). Lewis Publ., Boca Raton, Florida.
- Hudson, R. H., R.K. Tucker, M.A. Haegele. 1984. Handbook of Toxicity of Pesticides to Wildlife. U.S. Fish & Wildlife Service, Resource Publication 153.
- Jones, William (pers. comm.). 1996. Dept. of Natural Resources and Environmental Control; Dover, DE
- Kushlan, J. A. 1993. Colonial waterbirds as bioindicators of environmental change. Colonial Waterbirds 16: 223-251.
- Landis, W. G. and M. Yu 1995. Introduction to Environmental Toxicology: Impacts of Chemicals Upon Ecological Systems. Lewis Publishers, Boca Raton, Florida.
- Laporte, P. 1982. Organochlorine residues and eggshell measurements of Great Blue Heron eggs from Quebec. Colonial Waterbirds 5: 95-103.
- Lemly, D. A. and G.J. Smith. 1987. Aquatic Cycling of Selenium: Implications for Fish and Wildlife. U.S. Fish Wildl. Serv. Fish and Wildlife Leaflet No. 12.

**Pea Patch Island Heronry Region
Special Area Management Plan
July 1998**

- Ludke, J. L., E. F. Hill and M. P. Dieter. 1975. Cholinesterase (ChE) response and related mortality among birds fed ChE inhibitors. *Arch. Environ. Contam. Toxicol.* 3: 1-21.
- Mayer, F. L., D. J. Versteeg, J. J. McKee, L. C. Folmar, R. L. Graney, D. C. McCume and B. A. Rattner. 1992. Physiological and nonspecific biomarkers. *In* Biomarkers--biochemical, physiological, and histological markers of anthropogenic stress (R. J. Huggett, R. A. Kimerle, P. M. Mehrle, and H. L. Bergman, eds.). SETAC Spec. Publ. Series, Lewis Publ., Boca Raton, Florida.
- Miller, R.W. (pers. comm.). 1996. Dept. of Natural Resources and Environmental Control; Dover, DE
- Moriarty, F. 1988. *Ecotoxicology: the study of pollutants in ecosystems*. Academic Press, London.
- Mueller, A. J. and P. O. Glass. 1988. Disturbance tolerance in a Texas waterbird colony. *Colonial Waterbirds* 11(1): 119-122.
- Murphy, S. D. 1986. Toxic effects of pesticides. *In* Toxicology: the basic science of poisons (C. D. Klassen, M. O. Amdur, and J. Doull, eds.). MacMillan, New York.
- National Center for Food and Agricultural Policy. 1992. National database of agricultural pesticide applications. Washington, DC
- National Oceanic & Atmospheric Administration. 1996. Coastal oil spill mapping system. Silver Spring, MD: Strategic Environmental Assessments Division, Office of Ocean Resources Conservation and Assessment, National Ocean Service, NOAA. Unpublished data base.
- New Castle County Department of Planning. 1996. Southern New Castle County Land Use Study. New Castle County Department of Planning. 85 pp. and appendices.
- New Jersey State Planning Commission. 1992. Communities of Place. New Jersey State Planning Commission. 183 pp.
- Northern Delaware Wetlands Rehabilitation Program. Delaware Department of Natural Resources & Environmental Control, Division of Fish & Wildlife and Division of Soil & Water Conservation. Dover, DE.
- Ogden, J. C. 1978. Recent population trends of colonial wading birds on the Atlantic and Gulf coastal plains. *In* Wading Birds (A. Sprunt, J. C. Ogden, and S. Winckler, eds.). *Nat Audubon Res Rep* 7: 137-154.
- Pait, A. S., A. E. DeSouza 1992. Agricultural Pesticide Use in Coastal Areas: A National Summary. Rockville, MD: National Oceanic and Atmospheric Administration, 112 pp
- Palmer, W. E. and P. T. Bromley. 1992. Wildlife and agricultural pesticide use: A review for natural resource managers. North Carolina Coop. Ext. Service, NC State Univ. 27 pp.
- Parsons, K. C. 1994. The Arthur Kill Oil Spills: Biological Effects to Birds. *In* Before and After an Oil Spill: The Arthur Kill (J. Burger, Ed.). Rutgers Univ. Press, New Brunswick, New Jersey.
- Parsons, K. C. 1995. Heron nesting at Pea Patch Island, upper Delaware Bay, USA: Abundance and reproductive success. *Colonial Waterbirds* 18: 69-78.

- Parsons, K. C. and J. Burger. 1982. Human disturbance and nestling behavior in Black-crowned Night-Herons. *Condor* 84: 184-187.
- Parsons, K. C. and A. C. McColpin. 1995. Great Blue Heron reproductive success in upper Delaware Bay. *J. Field Ornithol.* 66: 184-191.
- Parsons, K. C. 1993. The Pea Patch Island wader colony: a proactive plan for natural resource protection and management. Tech. Rpt., Delaware Dept. of Natural Resources and Environmental Control, Dover, Delaware, 37 pp.
- Parsons, K. C. 1998. Personal Communication.
- Parsons, K. C. 1996. Recovering from Oil Spills: The Role of Proactive Science in Mitigating Adverse Effects. *Colonial Waterbirds* 19(1): 149-153.
- Parsons, K. C. 1996. Significant wetlands of upper Delaware Bay: Habitat status and relationship to the Pea Patch Island wading bird colony. Draft Final Rep submitted DNREC. 101 pp.
- Parsons, K. C., A. C. Matz, and S.R. Schmidt. 1998. Wading birds and cholinesterase-inhibiting insecticides: An examination of exposure and effects in free-living populations. Interim Report to Delaware Department of Natural Resources & Environmental Control.
- Piapp, F.W. 1991. The Nature, Modes of Action, and Toxicity of Insecticides in the CRC Handbook of Pest Management in Agriculture Vol II. David Pimental, editor, 2nd edition. CRC Press Inc. Boca Raton.
- Pimental, D. (ed.). 19 . CRC Handbook of pest management in agriculture, 2nd ed.
- Ranglack, G., R. A. Angus, and K. R. Marion. 1991. Physical and temporal factors influencing breeding success of Cattle Egrets (*Bubulcus ibis*) in a west Alabama colony. *Colonial Waterbirds* 14: 140-149.
- Research Planning Inc. 1991. Oil and hazardous substances pollution incidents-planning and response considerations: Philadelphia, Pennsylvania. Columbia, SC: RPI, Inc., 97 pp. + appendices.
- Rodgers, J. A. 1980. Breeding ecology of the Little Blue Heron on the west coast of Florida. *Condor* 82: 164-169.
- Rodgers, J. A., S. T. Schwikert, and A. S. Wenner. 1993. The prevalence of abdominal lesions on Wood Stork nestlings in north and central Florida. *Condor* 95: 473-475.
- Rodgers, Jr., J. A. and H. T. Smith. 1995. Set-back distances to protect bird colonies from human disturbance in Florida. *Conservation Biology* 9(1): 89-99.
- Salem County Planning Board. 1995. Interim Salem County Traffic & Transportation Report. Salem, NJ.
- Salem County Planning Board. 1993. Natural Features Report Salem County New Jersey. Salem, NJ.
- Salvesen, D. 1990. *Wetlands: Mitigating and Regulating Development Impacts*. Urban Land Inst, Wash. DC. 117p.

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

- Smith, G.J. 1987. Pesticide Use and Toxicology in Relation to Wildlife: Organophosphorus and Carbamate Compounds. U. S. Fish & Wildlife Service Resource Publication 170.
- Smith, G. J., J. W. Spann, and E. F. Hill. 1986. Cholinesterase activity in Black-crowned Night-Herons exposed to fenthion-treated water. Arch. Environ. Contam. Toxicol. 15: 83-86.
- Sneddon, L. A., K. J. Metzler, and M. Anderson. 1995. A classification and description of natural community alliances and selected community elements of the Delaware Estuary (Summary). Pp. 3-24 *in* Living Resources of the Delaware Estuary (L. E. Dove and R. M. Nyman, eds.). The Delaware Estuary Program.
- Snyder, N. F. R., J. C. Ogden, J. D. Bittner, and G. A. Grau. 1984. Larval dermestid beetles feeding on nestling Snail Kites, Wood Storks, and Great Blue Herons. Condor 86: 170-174.
- Soule, M. E. and K. A. Kohm. 1989. Research Priorities for Conservation Biology. Island Press, Critical Issues Series, Washington, DC.
- Spendelow, J. A. and S. R. Patton. 1988. National Atlas of Coastal Waterbird Colonies in the Contiguous United States: 1976-1982. USFWS Biol Rep 88(5). 326p.
- Sullivan, J. K., T. Holderman, and M. Southerland. 1991. Habitat status and trends in the Delaware Estuary. Report submitted Delaware Estuary Program. 170pp.
- Sutton, C. C., J.C. O'Herron, II, and R.T. Zappalorti. 1996. The Scientific Characterization of the Delaware Estuary. The Delaware Estuary Program (DRBC Project No. 321; HA File No. 93.21).
- Szemedra, P.I. 1991. Pesticide Use in Agriculture' in the CRC Handbook of Pest Management in Agriculture Vol I. David Pimental, editor. 2nd edition. CRC Press Inc. Boca Raton.
- Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish & Wildlife Service, National Wetlands Inventory, Newton Corner, MA and Delaware Department of Natural Resources & Environmental Control, Wetlands Section, Dover, DE. Coop. Publ. 77 pp.
- Tremblay, J. T. and L. N. Ellison. 1979. Effects of human disturbance on breeding of black-crowned night herons. Auk 96: 364-369.
- U. S. Army Corps of Engineers. 1976-1995. Waterborne commerce of the United States, calendar years 1975-1994, part 1 waterways and harbors Atlantic Coast. Fort Belvoir, VA: The Water Resources Support Center.
- U. S. Coast Guard. 1995. Philadelphia area contingency plan. Philadelphia, PA: Marine Safety Office/Group, U.S. Coast Guard.
- U.S.D.A. Herbicide Handbook. 7th edition. 1994, pp. 149-152.
- Whittendale, T. W. 1995. Canada and Snow Geese. Pp. 367-374 *in* Living Resources of the Delaware Estuary (L. E. Dove and R. M. Nyman, eds.). The Delaware Estuary Program.
- Wiese, J. H. 1979? Heron nest-site selection and its ecological effects. Manomet Bird Observatory and Tall Timbers Research Station. 8 pp.

Wiese, J. H. 1979. A study of the reproductive biology of herons, egrets, and ibis nesting on Pea Patch Island, Delaware. Final Interpretive Rep. 255p.

SAMP DOCUMENTS

Pea Patch Island Heronry Region Special Area Management Plan: Draft Issue Characterization Package, December 1996.

Pea Patch Island Heronry Region Special Area Management Plan: Issue Characterizations, March 1997.

Pea Patch Island Heronry Region Special Area Management Plan: Issue Characterization Workshop Summary Document, February 1997.

Pea Patch Island Heronry Region Special Area Management Plan: Research and Biomonitoring Information Catalog, January 1997.

Pea Patch Island Heronry Region Special Area Management Plan: Strategy Workshop Summary Document, June 1997

Pea Patch Island Heronry Region DRAFT Special Area Management Plan, February 1998.

DEFINITIONS of ACRONYMS

ASA.....Applied Science Associates, Inc.	DNREC.....Delaware Department of Natural Resources and Environmental Control
AVMSAS.....ArcView Marine Spill Analysis System	DNS.....Delaware Nature Society
BMP.....Best Management Practice	DOI.....United States Department of the Interior
C&D.....Chesapeake and Delaware	DOS.....Delmarva Ornithological Society
CAFRA.....Coastal Area Facility Review Act	DOT.....Department of Transportation
CCSPI.....Cabinet Committee on State Planning Issues	DPR.....DNREC Division of Parks and Recreation
CES.....Cooperative Extension Service	DRBA.....Delaware River and Bay Authority
CMP.....Coastal Management Program	DRBC.....Delaware River Basin Commission
COMPAS.....Coastal Ocean Management, Planning and Assessment System	DSWC.....DNREC Division of Soil and Water Conservation
CZMA.....Federal Coastal Zone Management Act	DWR.....DNREC Division of Water Resources
DACD.....Delaware Association of Conservation Districts	EEP.....PSE&G Estuary Enhancement Program
DASS.....Delaware Agricultural Statistics Service	EPA.....United States Environmental Protection Agency
DBRC.....Delaware Bay and River Cooperative	ESI.....Environmental sensitivity index
DCMP.....Delaware Coastal Management Program	F&W.....DNREC Division of Fish and Wildlife
DDA.....Delaware Department of Agriculture	FSA.....Farm Service Administration
DDE.....Dichlorodiphenyethane	FTE.....Full Time Employee
DDT.....Dichlorodiphenyltrichloroethane	GIS.....Geographic Information System
DelDot.....Delaware Department of Transportation	LOEL.....Low observed effects level
DELEP.....Delaware Estuary Program	LUPA.....Land Use Planning Act
DFW.....Division of Fish and Wildlife	MAFMC.....Mid-Atlantic Fisheries Management Council
DLG.....Digital Line Graph	MOT.....the Middletown, Odessa and Townsend Delaware area

**Pea Patch Island Heronry Region
Special Area Management Plan
July 1998**

MSRC.....	Marine Spill Response Corporation	PDR.....	Purchase of Development Rights
NCC.....	New Castle County, Delaware	PPAC.....	Philadelphia Port Area Committee
NCCD.....	New Castle Conservation District	PCB.....	Polychlorinated biphenyl
NDWRP.....	Northern Delaware Wetlands Rehabilitation Program	PPI.....	Pea Patch Island
NERRS.....	National Estuarine Research Reserve System	PPIHR.....	Pea Patch Island Heronry Region
NGO.....	Non-governmental organization	PSE&G.....	Public Service Electric and Gas
NJDAG.....	New Jersey Department of Agriculture	QI.....	Qualified Individual
NJDEP.....	New Jersey Department of Environmental Protection	RBA.....	Riparian Buffer Area
NJDOT.....	New Jersey Department of Transportation	RC&D.....	Resource Conservation and Development Council
NMFS.....	National Marine Fisheries Service	RCRA.....	Resource Conservation and Recovery Act
NOAA.....	National Oceanic and Atmospheric Administration	RRT.....	Regional Response Team
NOEL.....	No observed effects level	SAMP.....	Special Area Management Plan
NPDES.....	National Pollutant Discharge Elimination System	SEA.....	Strategic Environmental Assessments Division (NOAA)
NPL.....	National Priorities List	SRA.....	State Resource Areas
NRC.....	National Response Corporation	TCPA.....	Toxins Categorical Prevention Act
NRCS.....	Natural Resources Conservation Service	TDR.....	Transfer Development Rights
NRDA.....	Natural Resources Damage Assessment	TMDL.....	Total Maximum Daily Loadings
ORCA.....	Office of Ocean Resources Conservation and Assessment (NOAA)	UD.....	University of Delaware
OSPC.....	Office of State Planning Coordination	UDC.....	Unified Development Code
OSPFPC.....	Open Space, Parks, and Farmland Preservation Coalition	USACE.....	United States Corps of Engineers
OSRO.....	Oil Spill Removal Organization	USCG.....	United States Coast Guard
P&I.....	Protection and Indemnity	USDA.....	United States Department of Agriculture
PADEP.....	Pennsylvania Department of Environmental Protection	USFWS.....	United States Fish and Wildlife Service
		USGS.....	United States Geological Survey
		VOCs.....	Volatile Organic Compounds
		VRP.....	Vessel Response Plan
		WASP.....	Water Quality Analysis Simulation Program
		WQ.....	Water quality

**Pea Patch Island Heronry Region
Special Area Management Plan
July 1998**

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***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

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Special Area Management Plan
July 1998***

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Special Area Management Plan
July 1998**

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***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

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July 1998**

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Special Area Management Plan
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**Pea Patch Island Heronry Region
Special Area Management Plan
July 1998**

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***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

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Original and Complete List of Targets and Strategies

Habitat Change - Development Strategies

HD-1 Establish TDR receiving areas

- HD-1.1* Identify resources and their sensitivity
- HD-1.2* Establish better coordination between groups involved in defining growth areas
- HD-1.3* Educate property owners about the implementation process and related equity issues

HD-2 Protect/restore riparian and wetland buffers

- HD-2.1 Explore method for establishing statewide buffer ordinance
- HD-2.2* Define and enforce performance standards for open space, including minimizing placement and modifications of stormwater controls
- HD-2.3 Provide input to Whole Basin Management process

HD-3 Protect land in sending areas

- HD-3.1 Establish minimum requirements for open space
- HD-3.2* Provide design guidance for development in sending areas - focus on protecting contiguous areas
- HD-3.3* Periodic assessment of habitat conditions for adjusting protection/guidance measures
- HD-3.4* Explore alternative methods to ensure protection - new zoning, application of other programs, etc.

HD-4 Establish criteria/procedures for protecting uplands

- HD-4.1** Increasing public acquisition of land targeted by potential development
- HD-4.2 Coordinate acquisition efforts with other types of planning initiatives
- HD-4.3* Assess methods for downsizing - determine their viability
- HD-4.4 Establish methods for retiring unbuilt development/subdivisions (sunset)

HD-5 Endorse plans that support cluster development and preservation of open space

- HD-5.1* Improve process for implementing cluster development (analyze/modify current ordinance)
- HD-5.2* Explore incentives that help protect open space, e.g., tax incentives (federal/state/county)
- HD-5.3* Make it mandatory that information is supplied to the Development Advisory Service (DAS)
- HD-5.4 Reduce inefficient use of land by establishing minimum lot sizes or maximizing gross densities
- HD-5.5 Explore methods for placing controls on total amount of impervious surface allowed (for initial & subsequent development)

HD-6 Endorse the development of Brownfields

- HD-6.1* Develop and establish a program to encourage the restoration of Brownfield sites

HD-7 Implement new technologies/alternative WWT

- HD-7.1 Assess performance of alternatives
- HD-7.2 Assess potential partnership issues to help implement alternatives

HD-8 Minimize stormwater runoff

- HD-8.1* Improve stormwater management designs
- HD-8.2 Change stormwater control specifications
- HD-8.3 Revise existing drainage codes to prevent channelization
- HD-8.4* Retrofit stormwater controls based on reducing volume and peak discharge
- HD-8.5* Revise land-use controls relative to road improvements/construction

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

HD-9 Improve education and outreach efforts

- HD-9.1** Develop a land preservation tool box
- HD-9.2** Establish a means to recognize property owners and developers that help preserve natural habitats, i.e., awards program
- HD-9.3* Educate general public on planning process - what it means

Pesticide Strategies

PE-2 Increase use of Integrated Crop Management & Integrated Pest Management BMPs through research, education and outreach efforts

- PE-2.1** Promote BMPs for implementation by agriculture, homeowners, pest control industry, right-of-way/maintenance, landscape professionals. Increase use of IPM, BMPs through education and outreach efforts
- PE-2.2 Fund/encourage research to develop new BMPs
- PE-2.3 Further outreach efforts to publicize BMPs

PE-3 Expand existing technical assistance & funding of programs

- PE-3.1* Maintain/expand funding for USDA programs
- PE-3.2* Fund two new positions (NJ & DE) or identify existing personnel for coordinating technical assistance (college interns, etc.) for PPI
- PE-3.3* Identify alternate funding sources for technical assistance

PE-4 Promote improved techniques to decrease runoff

- PE-4.1* Identify, catalog & rate techniques that reduce runoff
- PE-4.2* Support research to develop new techniques that reduce runoff
- PE-4.3 Implement best techniques

PE-6 Quantify pesticide usage in PPI heronry region

- PE-6.1** Quantify relative homeowner use of pesticides
- PE-6.2** Assess compliance of pesticide use
- PE-6.3 Determine relative impact of pesticide application by landuse

PE-8 Assess positive/negative impacts of existing invasive plant control programs

- PE-8.1** Develop list of invasive plants and control efforts/programs
- PE-8.2** Assess positive and negative impacts of programs to: birds, prey species, habitat changes and nesting site availability.

PE-9 Strategies Not Specific to Any Target

- PE-9.1 Distribute research results nationally
- PE-9.2 Identify positive values of heronry (ecotourism, etc.)
- PE-9.3 Identify how effective herons are as indicators of environmental problems or health
- PE-9.4 Assess whether the 15 Km radius is sufficiently large for capturing man's effects on the herons

Contaminants Strategies

C-1 Reduce contaminants impacts associated with dredging and spoil disposal

- C-1.1** Improve operation & maintenance of confined disposal sites
- C-1.2* Restrict open water disposal of contaminated materials
- C-1.3** Establish sediment & water quality criteria for fish & wildlife
- C-1.4** Establish a consistent interstate framework for reviewing dredging projects
- C-1.5* Establish a protocol for screening sediment at resolution that permits segregation and disposal of "hot spots"

- C-1.6* Establish an information management system for dredging decision making
- C-2 Reduce contaminants impacts from industrial and municipal effluents**
 - C-2.1* Add fish and wildlife criteria to the Total Daily Maximum Loading process
 - C-2.2** Target pollution prevention at industries that release contaminants of concern
 - C-2.3* Ensure adequate enforcement of NPDES
- C-3 Determine other sources of contaminants of concern**
 - C-3.1* Reduce Nonpoint Source Stormwater Impacts
 - C-3.2* Establish monitoring program to evaluate atmospheric deposition contributions
- C-4 Determine connection between contaminants and wading birds**
 - C-4.1** Quantify effects (or lack of) of contaminants on wading birds
- C-5 Eliminate contaminants impacts from hazardous waste sites**
 - C-5.1** Prioritize sites for clean-up according to wading bird use

Oil Spill/Industrial Accident Strategies

- OS-1 Improve response capabilities**
 - OS-1.1 Prioritize Sensitive Areas for protection (revisit current ratings in Area Plan)
 - OS-1.2** Produce NRDA estimates for Sensitive Areas based on the spill scenarios in the Area Plan
 - OS-1.3 Stage vessel fire fighting capabilities in the Heronry region
 - OS-1.4** Standardize (up) PA, DE, NJ oil transfer/booming requirements
 - OS-1.5 Assess effectiveness of available response resources (especially at Sensitive Areas)
 - OS-1.6* Improve/standardize spill response training (wildlife rehabilitation, NRDA evidence collection, health and safety for workers, and other topics)
- OS-2 Improve the Scientific Response capability of NRDA activities**
 - OS-2.1 Pre-identify potential restoration projects
- OS-3 Develop alternate/improved strategies for difficult areas**
 - OS-3.1** Pre-stage more resources at "A" rated areas for better access at sensitive locations
 - OS-3.2** Address "gap" in Salem River/Mannington Meadows response plan
 - OS-3.3** Establish permanent anchor points for booming
- OS-4 Test/modify the current booming strategies**
 - OS-4.1** Drill all of the Sensitive Areas in the 15 km zone in next two years in priority order based on wading bird use
- OS-5 Reduce the number of spills through better education, training, inspections, etc.**
 - OS-5.1 Evaluate existing preventive programs
 - OS-5.2 Heighten oil/chemical industry awareness about resources in region by season
 - OS-5.3 Inspect facilities based on risk, etc.
- OS-6 Improve the Wildlife Response Protocol for the Area Plan**
 - OS-6.1** Include in the Wildlife Response Protocol a plan for 1) hazing wildlife from affected areas, 2) retrieval of wildlife, and 3) coordinating transfer of wildlife
- OS-7 Develop a better understanding of spill impacts on the food chain**
 - OS-7.1 Better understand "off season" spill impacts on wading birds and their food chain
 - OS-7.2 Better understand impacts of frequently spilled materials in highest volumes in region
 - OS-7.3 Better understand potential benefits/costs of using dispersants
- OS-8 Form a better understanding of the number, type, and location of accident causes**
 - OS-8.1* Assess existing state of oil/chemical spill "risk"
- OS-9 Develop education and outreach programs on spills tailored to specific audiences (general public, decision makers)**

**Pea Patch Island Heronry Region
Special Area Management Plan
July 1998**

- OS-9.1** Develop education and outreach programs on spills tailored to specific audiences (general public, decision makers)
- OS-9.2 Get state of the spill response capability out at NEP conference or other fora
- OS-10 Increase the "Oh my god!" level of awareness of Qualified Individuals**
- OS-10.1 Identify priority Qualified Individuals to contact
- OS-10.2 Develop a presentation describing importance of heronry to East Coast wading bird populations as a whole
- OS-10.3 Conduct seminar for Qualified Individuals at an existing event or as a separate function

Habitat Improvement and Protection Strategies

- HI-1 Restore/Improve 10,000 acres of wetlands within Delaware and 3,000+ acres of wetlands within New Jersey over 10+ years**
 - HI-1.1** Gain access and control for restoration/improvement with/from landowners
 - HI-1.2 Continue to implement NDWRP
 - HI-1.3* Identify & characterize areas for restoration and improvement (Identify areas for mitigation banking; Tally up DE & NJ acreage and conditions to see what's being done; Identify available lands and programs for restoration and improvement.
 - HI-1.4* Develop a program in NJ similar to DE's NDWRP
- HI-2 Integrate heron foraging and nesting needs on a seasonal basis with other marsh management needs within the next 5 years**
 - HI-2.1** Reduce phragmites and other nuisance species by 3,000 acres throughout the PPI Region within 5 to 10 years
 - HI-2.2 Clarify and Coordinate definition of "Restoration" for heron needs
 - HI-2.3 Integrate water level management (includes non-wildlife approaches)
 - HI-2.4** Review and make recommendations (where appropriate) existing plans for PPI needs (Evaluate existing restoration plans (DE & NJ) and Existing Wildlife Plans for PPI Benefits (State & Fed.)
- HI-3 Establish minimum buffers around wetlands within 10 years**
 - HI-3.1** Establish criteria based on: a) type and function of wetlands area; and b) overall wildlife benefits
 - HI-3.2** Incorporate buffer plans into the New Castle County Comprehensive Land Use Plan
 - HI-3.3* Determine feasibility of classifying wetland values and applying buffers in New Jersey for incorporation into Exceptional Resource Value program
 - HI-3.4* Restore and Re-establish buffers where previously removed
- HI-4 Expand the existing available nesting habitat at the PPI Rookery by 15 acres within 10 years**
 - HI-4.1 Stabilize erosion of PPI within 5 years
 - HI-4.2** Regenerate and perpetuate nesting habitat on the island within 5 years
 - HI-4.3* Control predators on the island within 5 years
 - HI-4.4* Add extra land to the island
- HI-5 Expand the existing available nesting habitat outside the PPI Rookery**
 - HI-5.1* Identify Alternative Nesting Sites
 - HI-5.2* Develop an incentive program for private landowners with herons nesting on their property with 5 years
- HI-6 Improve Land Acquisition**
 - HI-6.1** Develop specific criteria for heronry requirements for Land Acquisition and Protection
 - HI-6.2* Incorporate Heron Criteria into DE, NJ, USFWS, & Private Land Acquisition and Protection Programs. (include need for partners in this process)
- HI-7 Improve Awareness & Education for the PPI Heronry Region**

HI-7.1** Communication/Outreach that creates a greater awareness of the heronry and its importance for the general public and targeted audiences.

Note: Targets identified under each of the issues are shown in boldface type.

This list reflects the original strategy titles and reference numbers - changes to strategy titles and numbers have been made since the 4/2/97 workshop and they are reflected in the SAMP document.

** Strategy was written up at 4/2/97 workshop.*

*** Strategy included as part of the SAMP Document.*

-CHARTER DOCUMENT-
The Pea Patch Island
Special Area Management Plan Implementation Team:
Mission, Objectives and Operations

Background

Pea Patch Island, located in the upper reach of the Delaware Estuary, emerged from the Delaware River in the late 1700's as a mud bank, which reportedly grounded a ship full of peas, giving the island its name. In 1814, after the mud bank had grown and formed into an island, a military Fort, Fort Delaware was built to guard river access to New Castle, Wilmington, and Philadelphia. In the early 1900's, the Army Corps of Engineers placed dredged material from the nearby shipping channel on the north end of the island, doubling the island's size.

Today Pea Patch Island is a Delaware State Park, protected for its historical past and because it supports a large heron rookery. It is believed that herons, egrets, and ibises began nesting on the northern part of the 310-acre island in the 1950's and 1960's. At that time, the population was estimated at 2,000 pairs of birds. Over time, small heronries on the mainland in Delaware and New Jersey were abandoned and the population on Pea Patch Island increased. At its peak, in 1993, the population was estimated at 12,000 pairs of birds making the Pea Patch Island heronry the largest heronry on the East Coast, north of Florida.

The heronry is considered a wildlife resource of national significance due to its size and location. Concern for the sustainability of the heronry has grown over the past few years because the number of birds is declining on the island. Present population estimates are at 6,120 pairs (Parsons 1998). Research and biomonitoring studies have been conducted for the past five years at Pea Patch Island. This research indicates that there may be a problem with the long-term viability of the heron population on the island.

Identifying what may be affecting the bird population at Pea Patch Island involves looking at more than the immediate nesting habitat on the island. The herons that live on the island forage for food in the neighboring wetlands and open fields of Delaware and New Jersey. These areas are presently challenged by rapid land use changes: changes that alter the habitat and may impact the birds.

In order to better manage this unique resource, a Special Area Management Plan (SAMP) has been developed. Working together, representatives from local, state, and federal government agencies, nonprofit organizations, business, and industry identified a number of sources or concerns that could manifest themselves as problems or changes in the natural condition of the habitat that the birds utilize. Identifying and defining the problems that the heronry faces was the first step in this process. Once the problems or "issues" were thoroughly characterized, the SAMP process concentrated on developing strategies to address these issues.

Once a potential problem is identified, finding out how to solve it is what strategy development is all about. Occasionally the causes of a problem and its solutions are evident. However, it is usually the case that exact causes and solutions are unknowns. Strategies for knowns outline the steps to arrive at the desired solution and strategies for the unknowns outline information needs (research or monitoring) to reach conclusions on causes and potential solutions.

**Pea Patch Island Heronry Region
Special Area Management Plan
July 1998**

Out of 66 drafted management strategies, 30 were chosen to become a part of the SAMP document. The Pea Patch Island Core Group using a comprehensive ranking system based upon feasibility, environmental impacts, and socioeconomic impacts selected these 30 strategies. After drafting and reviewing, some strategies were considerably refined and combined. This resulted in a total of 28 strategies to be included in the Pea Patch Island Heronry Region SAMP.

Authority

The Delaware Coastal Management Program (DCMP) is the agency that instituted the development of the SAMP for the Pea Patch Island Heronry Region. The DCMP is located within the Delaware Department Of Natural Resources and Environmental Control's Division of Soil And Water Conservation. The DCMP is a state program created pursuant to the Federal Coastal Zone Management Act of 1972. This legislation provided guidance and funding towards the creation of state coastal management programs in order to ensure protection of the nation's coastal resources. The DCMP and its program document were approved by the National Oceanic and Atmospheric Administration's Office of Ocean and Coastal Resource Management (NOAA/OCRM) in 1979. The DCMP's program document is a comprehensive set of goals and policies based upon state environmental laws and regulations, including executive orders.

The DCMP's authority for initiating the Pea Patch Island Heronry Region SAMP is found in the congressional declaration of policy from the CZMA, "The Congress finds and declares that it is the national policy....(3) to encourage the preparation of special area management plans which provide for increased specificity in protecting significant natural resources, reasonable coastal-dependent economic growth, improved protection of life and property in hazardous areas, including those areas likely to be affected by land subsidence, sea level rise, or fluctuating water levels of the Great Lakes, and improved predictability in governmental decision making." *CZMA of 1972 as amended 16 U.S.C.A. § 1452*. The statute further goes on to define a Special Area Management Plan as, "A comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed and comprehensive statement of policies; standards and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone." The preparation and implementation of SAMPs for important coastal areas is also listed under section 309 of the CZMA as one of eight coastal zone enhancement objectives of this legislation.

Clearly, the development of SAMPs for important coastal areas as defined in the CZMA is an integral part of coastal zone management. Policies that are developed as part of this SAMP are to be included in the DCMP. This inclusion into the program is important because these policies would become part of the DCMP's review process for federal consistency. Federal consistency is a provision of § 307 of the CZMA which requires federal agencies to review their activities, evaluate, and ensure that any proposed activities, permits, plans and monies which may affect the coastal zone's land, water, and natural resources are "Consistent to the maximum extent practicable" with the coastal management program's enforceable policies. These policies could become an effective coastal management tool for federal consistency reviews specifically aimed at the protection of the Pea Patch Island Heronry Region.

Included as part of the DCMP's program approval in 1979 an Executive Order was signed by then Governor, Pete duPont. Executive Order #61 declared that all State departments and agencies shall enforce the goals, policies, and objectives of the DCMP and notify the DCMP of proposed changes in rules or regulations which may have the potential for interfering with DCMP or would require amendments to be made to the DCMP. The reason for establishing this Executive Order was to provide, "Sufficient legal authorities and organizational arrangements to implement the program (DCMP) and to ensure conformance to it." *15 CFR § 923.1(c)(6)*. Without this assurance that the DCMP's policies would be enforced at the federal and state levels the DCMP would not

Appendix D

have been approved. In 1996, Governor Tom Carper signed an “updated” Executive Order #61, now known as #43, which reflects the organizational changes that have occurred since the original enactment in 1979. The 1996 version reintroduces and enforces all state departments and agencies to enforce the goals, policies, and objectives of the DCMP.

Mission of the Implementation Team

The mission of the Implementation Team is to provide a framework for continuous regional coordination, communication, planning, funding and strategy implementation among federal, state and local agencies, public and private groups that are addressing the SAMP’s goals. Recognizing the importance of the heronry as a unique natural resource, the Implementation Team’s efforts should ensure that the survivability of the heronry and the regional ecosystem that supports it is an ongoing high priority for the public and all participating groups and jurisdictions.

Specific Objectives

The specific objectives of the Implementation Team are to:

- 1. Provide a forum for information sharing, discussion, and to generate public support for the Pea Patch Island Heronry Region SAMP and, to:**
 - Serve as a conduit to agencies, academia, public and private constituent groups to discuss and promote the SAMP strategies, exchange information and comments, garner support and target resources for implementation.
 - Support existing and proposed collaborative efforts, communication and education with key target audiences such as local governments, local residents, businesses, industry, and agriculture on SAMP issues.
 - Continue to support the SAMP’s community-based local and regional emphasis.
 - Provide a central forum to raise public and private interests and issues related to strategy implementation for discussion, evaluation and facilitation of resolution with responsible agencies and groups.
 - Ensure commitment of political/governmental bodies and decision-makers to SAMP goals and strategy implementation.
- 2. Coordinate the implementation of SAMP strategies:**
 - Facilitate and coordinate the implementation of the FY 1997-98 selected strategies:
 - Review status of SAMP implementation and develop new or refine existing strategies to address identified concerns.
 - Ensure that all stakeholder interests are represented during strategy implementation.
 - Evaluate and prioritize new issues which arise, and coordinate development and implementation of strategies to address them.

3. Identify and recruit the staff and funding resources necessary to support the implementation of SAMP strategies and the Implementation Team's operations:

- Develop annual funding and multi-agency staffing priorities for implementation.
- Identify and recruit staff and funding resources for all strategies, including pooling of in-kind services from multiple agencies.
- Investigate potential revisions of traditional agency approaches and staff allocations which would help facilitate a coordinated regional approach.
- Identify and prioritize opportunities for collaborative grant proposals for SAMP strategies, develop an annual timeline for grant submissions, and jointly identify appropriate participants.
- Coordinate development of collaborative grant proposals among federal, state and local agencies, nonprofit organizations and academia for SAMP strategies and related efforts.

4. Improve integration among existing programs and projects related to SAMP efforts.

- Identify and foster approaches to pooling the resources of various agencies, public and private groups to more efficiently address issues, including pooling of expertise, funding, staffing, information, etc.
- Identify and develop means to carry out SAMP goals and strategies through modification or strengthening of existing programs and projects.
- Foster communication and joint efforts with other Implementation Teams and committees related to the, SAMP region including the Delaware River Basin Implementation Team and the Delaware Estuary Program.
- Consolidate and reduce duplication among meetings, workshops and committees related to SAMP issues.
- Provide a forum for early communication among agencies to exchange information on local projects and permit issues as they arise, to reduce delays and conflicting agency reviews/requirements.

5. Establish a process for regular monitoring of progress toward SAMP goals.

- Evaluate progress towards implementation of the strategies, and annually prioritize implementation tasks for each strategy.
- Identify barriers to strategy implementation, and develop methods to remove them.
- Evaluate the success of implemented strategies.
- Recommend and carry out modifications for those strategies that are not successful.

Appendix D

Implementation Team Structure

The Implementation Team is composed of approximately 15-20 members representing relevant resource management agencies and key stakeholder groups in the main issue areas addressed by the SAMP. Membership on the Implementation Team is by invitation of the existing Core Group, which will invite key agencies and stakeholder groups to recommend appointments to the Implementation Team. Appointments are for three years with potential for renewal, and may be staggered.

The Implementation Team operates under the guidance of two Co-Chairs. One rotating Co-Chair and one permanent Co-Chair. The rotating Co-Chair is selected from the Implementation Team membership, and has a one-year appointment with potential for renewal. The permanent Co-Chair is a representative from the DCMP. The permanent Co-Chair and the rotating Co-Chair work together in facilitating all Implementation Team meetings.

Working "Issue Teams" of the Implementation Team will be established as needed, with formal approval of the Implementation Team membership. Each issue team will be chaired by a member of the Implementation Team, but will include multiple participants outside of the Implementation Team membership. Issue teams will be established to guide implementation of the SAMP strategies for individual issue areas, including, contaminants, pesticides, habitat improvement and protection, habitat-change development, oil spills/industrial accidents, education/outreach, and human disturbance. A team will be established to identify, prioritize and develop collaborative funding opportunities for implementation of the various SAMP strategies. A team will also be established to develop a framework for interagency regulatory coordination, and provide for more efficient exchange of information. The Implementation Team will rely upon the expertise of the Pea Patch Island SAMP Research & Biomonitoring Group for decision-making related to the ongoing and future research associated with SAMP strategy implementation.

The lead agency for administering the Implementation Team and facilitating its operations will be the DCMP, with assistance from other agencies as needed. However, the Implementation Team is not structured as an advisory body to DCMP, but rather as a team of agencies, academic, public and private groups working together and coordinating their activities with their respective organizations and constituents. The DCMP and its Administrator will also serve to function as an oversight entity to the Implementation Team, ensuring its mission is properly fulfilled. There will be a system of checks and balances to ensure that the DCMP fulfills its responsibilities to the Implementation Team.

Representation

Implementation Team representation:

Implementation Team membership is designed to be diverse, with representation from relevant agencies and stakeholder groups. Prior to selecting Implementation Team members, clear definitions will be developed for what agencies or stakeholder group(s) each member is representing. For example, a government representative for an individual county would be responsible for communicating with County Planning, Environmental Health, Public Works, Board of Supervisor's, etc. A designated representative for agriculture would be responsible for communicating with Farm Bureaus, agricultural task forces and advisory committees, agricultural Advisory Groups, etc.

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

Representation on the Implementation Team will include, but not be limited to:

- Relevant federal, state and local government resource management agencies.
- Public and private groups with responsibilities and interests in related areas of SAMP issue areas.
- Stakeholder groups concerned with the main issue areas addressed by the SAMP, including but not limited to: contaminants, pesticides, habitat improvement and protection, habitat-change development, oil spills/industrial accidents, and education/outreach.

Suggested agency representation/membership on the Implementation Team is as follows but will ultimately be decided by the existing Core Group:

Federal:

National Oceanic & Atmospheric Administration
Environmental Protection Agency
US Fish & Wildlife Service
Army Corps of Engineers
US Department of Agriculture

State:

DE Department of Natural Resources and Environmental Control
DE Department of Agriculture
NJ Department of Environmental Protection

Local:

New Castle County
Salem County

Other representatives

Academia--research/monitoring
Agriculture
Business/Tourism
Boating/fishing
Elected officials--federal/state
Environmental
Industry
Landowners
Non-Profit Organizations

The membership of the Implementation Team may change over time as the priorities of the Implementation Team change and as new issues emerge.

Implementation Team members will be representatives who have been officially designated by their agency or constituent groups. Each organization should consider the individual characteristics needed to effectively meet the responsibilities of participation when identifying an individual to represent them on the Implementation Team.

Selected Implementation Team participants should be individuals who regularly participate in communication networks and decision-making within their organization or agency in order to

Appendix D

effectively participate in Implementation Team activities. Selected participants should have a broad knowledge of the interests and activities of the agency, organization or constituent group they represent, and be able to cast votes as a Implementation Team member on behalf of that group. However, members will be allowed sufficient time to consult with colleagues, agency management, constituents, etc. prior to making a decision on key issues.

Full and active participation in Implementation Team activities and SAMP strategy implementation should be a recognized portion of the annual workplan of Implementation Team members and designated staff associates. Selected participants should as necessary obtain the assistance of other members of their organizations or constituent groups to assist them in carrying out SAMP goals and activities.

Implementation Team members should designate an official alternate representative when they join the Implementation Team, who may occasionally participate in meetings if the Implementation Team member is unable to attend. The Implementation Team member is responsible for keeping the designated alternate apprised of relevant issues.

Implementation Team members must attend at least 3/4 of all scheduled quarterly meetings of the full Implementation Team per year to remain a formal member. If an individual determines he/she can no longer effectively participate as a member of the Implementation Team, a permanent substitute may be chosen. All members will be advised of such requests.

Staff members are welcome to attend with a Implementation Team member as needed. Other resource people may also be invited by the Implementation Team to provide additional information. These parties may participate in Implementation Team deliberations as requested.

Issue Team representation:

Issue Team members will include selected Implementation Team members as well as representatives from the various agency and stakeholder groups appropriate for each individual planning issue. The Implementation Team will jointly develop the initial membership of the Issue Teams and invite participation. The Issue Team Chairs may subsequently solicit additional participants as needed for particular issues.

Responsibilities of Membership

Implementation Team Chair and Co-Chair responsibilities:

The Chair and Co-Chair are responsible for serving the entire membership in any way possible in the conduct of Implementation Team meetings and other activities. The Chair and Co-Chair will work together to convene, plan and co-facilitate all Implementation Team meetings.

Implementation Team member responsibilities:

Under the guidance of the Chair and Co-Chair, the entire membership is responsible for reviewing and supporting the overall mission of the Implementation Team, as well as ensuring that progress is made in pursuing specific objectives needed to achieve the mission. Implementation Team members will review the mission and the specific objectives of the Implementation Team annually and modify them where necessary.

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

Implementation Team members will review, comment and issue final approval of any new strategies developed by the Issue Teams. Implementation Team members will review, comment and issue approval of recommendations for annual implementation priorities or strategy modifications developed by the Issue Teams.

Implementation Team members are expected to communicate and consult regularly with their respective organizations and constituent groups in order to be effective in executing their responsibilities as a Implementation Team member and to carry out the SAMP goals and activities. This includes:

- providing regular updates on strategy development and implementation
- exchanging information and comments to ensure that the plan meets the needs of diverse parties
- promoting the overall goals and specific objectives of the SAMP
- garnering support and resources for strategy implementation
- investigating and fostering efforts to integrate the program with the ongoing activities, programs and interests of their agencies/constituent groups.

Implementation Team members will also have responsibility for communicating with related statewide Implementation Teams and committees as well as local decision-making bodies including federal and state elected officials, etc.

Issue Team member responsibilities:

Issue Team members will be responsible for ongoing development and implementation of the individual strategies and issue areas. For issues addressed by existing strategies, responsibilities include ongoing review of progress towards strategy implementation, developing annual recommendations for specific task and funding priorities, identification and removal of barriers to implementation, and evaluation of the success of implemented strategies. Teams will also be responsible for development of strategy modifications or additions as necessary.

For those issue areas where a strategy has not been completed, Issue Team members will oversee development of the strategy in collaboration with a broad array of stakeholders. This will include problem assessment, development and prioritization of strategies based on evaluations of environmental benefits, economic impacts, and feasibility. Team members will also be responsible for exchanging information with interested parties and obtaining comments to ensure that the plan meets the needs of diverse groups.

Along with Implementation Team members, all issue team members are responsible for ongoing outreach and coordination with their agencies and constituent groups, including updates on strategy development and implementation, soliciting support and resources, and promoting integration of the SAMP with related programs and activities.

Issue Teams will provide regular updates to the Implementation Team on their activities and progress. Each Team will bring recommendations for final strategies, annual implementation priorities, funding and strategy modifications to the Implementation Team for review and approval. Issue Teams may make specific requests to the Implementation Team for assistance in meeting their goals, including requests for agency coordination, staffing, funding, etc.

Appendix D

Implementation Team and Issue Teams - Media Relations:

Members of the Implementation Team and or the Issue Teams, when approached by the news media regarding the Pea Patch Island Heronry Region SAMP implementation and associated activities must route all inquiries to the Implementation Team designated spokesperson. This person should be selected from the Implementation Team membership. It is the responsibility of the designated spokesperson to adequately convey the Implementation Team's unified intent, actions, and activities regarding the SAMP to the news media.

Groundrules for Implementation Team Deliberations

The success of the Implementation Team requires an effective partnership among all participants. Implementation Team members will share responsibility with the Chair and Co-Chair for the overall conduct of the Implementation Team. Implementation Team groundrules will be established to guide Implementation Team deliberations, and all members have joint responsibility with the Chair and Co-Chair for helping to enforce agreed-upon groundrules:

General:

- The Implementation Team will deliberate in plenary session, with the assistance of Issue Team members or other small working groups as needed and mutually agreed by all Implementation Team members.
- Each person is asked to fully participate in the Implementation Team's deliberations.
- Any concerns about the conduct of the deliberations of the issues should be fully aired to the group, or to the Chair or Co-Chair in private if appropriate, to ensure that deliberations are effective.
- Issue Teams, working groups, and the Research & Biomonitoring Group will keep the Implementation Team informed of their activities and obtain Implementation Team input as necessary.

Agenda-building:

- The permanent Co-Chair, rotating Co-Chair and Implementation Team members will jointly define what issues will be addressed by the Implementation Team and priorities for addressing the issues.
- At the end of each meeting, adequate time will be allocated for members to raise and discuss potential agenda items for the next meeting. To the extent possible, members will agree before adjourning what issues will be discussed at the upcoming Implementation Team meeting.
- The rotating Co-Chair is responsible, in collaboration with the permanent Co-Chair and members, to build the agenda for each meeting, and circulate this agenda and background materials to all members at least 10 working days in advance of the meeting.

***Pea Patch Island Heronry Region
Special Area Management Plan
July 1998***

- When new issues are raised at a Implementation Team meeting which are not on the agenda, formal action on these items may be postponed to allow adequate time for members to investigate the issue and confer with others as needed.

Decision-making:

- Only recognized members of the Implementation Team can participate in decision-making.
- The Implementation Team desires to operate by “consensus” wherever possible. Therefore, the Implementation Team will seek to reach consensus on all key decisions. This means that all members agree that they can “live with” the decision or the agreements being reached in order to move forward. Reaching consensus does not mean that individual members must compromise their fundamental interests on a given issue; rather that they can move forward with the language or agreement being reached.
- Members will be given adequate time to consider any key decision that must be made by the Implementation Team. This means that members should have sufficient time to consult with or seek the advice of constituents, agency management, etc., prior to making a decision on key issues.
- Disagreements will be addressed as issues to be resolved rather than battles to be won.
- Where consensus cannot be reached, members will first be asked to describe why agreement cannot be reached. Once the key areas of disagreement are clearly identified, the Chair and Co-Chair will again attempt to help the group reach consensus. If a situation exists where consensus still cannot be reached, the Chair will ask for a vote from participants on the issue in order to reach a decision (whenever this is appropriate).
- Commitments made should not be taken lightly and will be kept. When consensus is reached, or votes have been taken from participants, identified relevant Implementation Team members and their agencies/organizations must be committed to pursuing implementation of the Implementation Team’s recommendations.

Record-building:

- The Co-Chair and staff following each meeting will prepare an Implementation Team meeting summary. This meeting record will briefly summarize key points covered during each meeting as well as any decisions made by the Implementation Team. The meeting summary will be distributed to members for comments within 15 working days following each meeting. Final summaries from previous meetings will be available to all members before upcoming meetings.
- As a general rule, meeting summaries will capture key points of discussion without attribution to individual Implementation Team members. If all members agree that there is a necessity or value in attributing key points and ideas to individuals, this groundrule can be adjusted to meet member’s needs.

Appendix D

Changing groundrules:

- If members think the groundrules need to be modified at any point, the Co-Chair will present the proposed revisions to the membership and ask for discussion and concurrence.
- New rules or procedures should not be unilaterally applied without the prior notification of Implementation Team members.

Monitoring and Reporting on Implementation Team Activities

The Implementation Team will develop an annual reporting system including an annual report on the previous year's progress, and a shorter mid-year report which gives the Implementation Team an update on its progress in meeting that year's stated goals and objectives. This report will be produced by Team and be distributed to all participating agencies and organizations and to interested members of the public.

Measures of success should include: a) improved information channels and communication among the key parties and involved with the SAMP; b) measurable progress on implementing strategies to address SAMP issues; c) greater coordination on permitting, grant proposals, monitoring programs, etc., and d) continued education of Implementation Team members and constituent groups on key issues.

Matrix of Participating Institutions and Organizations

L=Lead Institution S= Supporting Institution

Institutions and Organizations	Strategies																											
	HD-1	HD-2	HD-3	HD-4	HD-5	PE-1	PE-2	PE-3	C-1	C-2	C-3	C-4	C-5	C-6	OS-1	OS-2	OS-3	OS-4	OS-5	OS-6	OS-7	HI-1	HI-2	HI-3	HI-4	HI-5	HU-1	OE-1
Applied Science Associates, Inc.															S													
Audubon Society																					S							
Brandywine Conservancy		S																										
Cabinet Committee on State Planning Issues	S	S	S																									
Cooperative Extension Service						L	S																					
Delaware Agricultural Statistics Service							L																					
Delaware Bay and River Cooperative, Inc.															S		S	S	S	S							S	
Delaware Department of Agriculture	S				S	S	S	S															S					
Delaware Department of Natural Resources and Environmental Control	L	S	L	L	S	S	S	S	L	L	L	L	S	S	L	S	S		S	S	S	L	L	L	L	L	L	L
Delaware Coastal Management Program							S	S			L																	
Division of Fish and Wildlife					S						S											L	L				S	
Division of Parks and Recreation	L				S																	S					L	
Division of Soil and Water Conservation											S											S					S	
Division of Water Resources											S																	
Delaware Department of Transportation								S																				
Delaware Estuary Program				S							S					L						S		S				S
Delaware Nature Society	S	S																										
Delaware Office of the Attorney General																						S						
Delaware Open Space Council	S	S																										
Delaware River Basin Commission									S	S	S																	S
Delaware Wildlands, Inc.	S	S																						S				
Delmarva Agricultural Chemicals Association						S																						
Farm Bureau						S																						
Farm Services Administration						S																						
Manomet Center for Conservation Sciences									S	S			L								S				S	S	S	
Marine Spill Response Corporation																	S	S										
National Marine Fisheries Service											S																	S
National Oceanic and Atmospheric Administration											S				S													S

Matrix of Participating Institutions and Organizations (con't)

Institutions and Organizations	Strategies																											
	HD-1	HD-2	HD-3	HD-4	HD-5	PE-1	PE-2	PE-3	C-1	C-2	C-3	C-4	C-5	C-6	OS-1	OS-2	OS-3	OS-4	OS-5	OS-6	OS-7	HI-1	HI-2	HI-3	HI-4	HI-5	HU-1	OE-1
National Response Corporation																	S	S	S	S								
Natural Resources Conservation Service						S																						
The Nature Conservancy	S	S		S																								
New Castle County Conservation District				S		S		L														S						
New Jersey Department of Environmental Protection	S			S		S	S	S	S	S	S	S		S	S	S	S	S	S	S	S	S	S	S		S		S
New Castle County Department of Planning	S			S																								
New Castle County Land Use Department					L																							
New Jersey Department of Agriculture																							S					
New Jersey Department of Transportation				S				S																				
New Jersey Office of the Attorney General																						S						
New Jersey Public Service, Electric & Gas																								S				
Office of State Planning Coordination	S	L	S																									
Open Space, Parks, and Farmland Preservation Council	S																											
Patuxent Wildlife Research Center													S															
Pennsylvania Department of Environmental Protection											S					S												S
Philadelphia Port Area Committee																S	S		L	S	S							
Resource Conservation and Development Council						S																						
Salem County Conservation District				S																		S						
Salem County Department of Planning	S			S																								
Star Enterprises									S																			
Tri-State Bird Research and Rescue																					S							S
United States Army Corps of Engineers									S		S								S								S	S
United States Coast Guard															S	S	L	L	S	L								S
United States Department of Agriculture																			S				S					
United States Environmental Protection Agency										S	S			S	S				S	S								S
United States Fish and Wildlife Service				S	S					S				L	S					S	L		S	S	S	S	S	S